COMMUNITY HEALTH WORKER ROLE EXPANSION FROM HIV TO MATERNAL, NEWBORN, AND CHILD HEALTH IN IRINGA, TANZANIA: A MIXED METHODS CASE STUDY

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Abstract

Background

Community health workers (CHWs) include many types of community-based health cadres. There is growing evidence that CHW interventions can improve a variety of health outcomes, and expansion of CHW programs is an important strategy for achieving Universal Health Coverage. With widespread shortages in the skilled health workforce, CHWs are being tasked with more complex and varied responsibilities, but whether CHWs should focus on one health area ("vertical" approach) or multiple health areas ("horizontal" approach) is still being debated. Central to this debate is appropriate CHW workload, with overload being a key risk. This dissertation explores the expansion of a single role CHW program focused on HIV to a dual role program of HIV *and* maternal, newborn, and child health (MNCH) in Tanzania. This research was designed to help guide implementation decisions by Tanzania's Ministry of Health as they develop a paid, national CHW cadre that will integrate work across multiple health areas.

Methods

A mixed methods case study examined an existing cadre of HIV-focused CHWs in two districts of Iringa Region: Iringa Rural and Kilolo. CHWs received additional MNCH training and supervision along with MNCH data reporting requirements. In Manuscript 1, interrupted time series analyses used routine monthly data on HIV and MNCH visit workload to assess whether CHWs could effectively provide additional MNCH services without compromising their HIV workload. Interrupted time series methods were again utilized in Manuscript 2 to evaluate whether MNCH health promotion by dual role CHWs increased the number of deliveries occurring at health facilities. In Manuscript 3, qualitative data from in-depth interviews with CHWs, supervisors, and program managers explored *how* CHWs managed additional MNCH responsibilities and *why* the integrated program worked (or not). Field observations documented implementation differences between HIV and MNCH roles among CHWs. The workload balance of HIV and MNCH household visits was examined, along with task prioritization, and drivers of feasibility, acceptability, and adoption of the integrated CHW model.

Results

Manuscript 1 presents quantitative evidence that HIV-MNCH integration by CHWs is feasible and confirmed that CHWs began conducting MNCH-related household visits shortly after training. However, in the immediate month of the MNCH intervention, an initial 6 to 9% drop in the average number of monthly HIV household visits among dual role CHWs was evident, relative to what would have been expected in the absence of the MNCH intervention (Iringa Rural: aIRR=0.94, p=.10; Kilolo: aIRR=0.91, p=.04). There was no significant difference between single and dual role CHWs in the trajectories of monthly HIV household visits before and after adding MNCH duties.

Manuscript 2 reports no significant change from baseline in the average number of facility deliveries observed at intervention health centers and dispensaries, relative to the expected change in the absence of the MNCH intervention. At the hospital level, there was a significant 16% increase in monthly deliveries at each district hospital, moving from an average of 202 to 234 deliveries in Iringa Rural and from 167 to 194 deliveries in Kilolo during the pre-intervention and intervention periods, respectively. Total facility deliveries were relatively stable over time at the district level, increasing about 1%, yet the relative change in the proportion of hospital deliveries out of total facility deliveries significantly increased by approximately 17% in Iringa Rural and 15% in Kilolo (p<0.001). Hence, community level efforts to counsel women on the importance of facility delivery may be an effective approach to increase hospital delivery.

Manuscript 3 showed that MNCH responsibilities can feasibly be added to the workload of HIV-focused CHWs. The additional MNCH tasks improved CHW satisfaction through increased respect in the community, new education and skills, and personal fulfilment from helping improve maternal and child health in their communities. However, the extra workload took time away from other income generating activities. Implementation was only “partially” integrated at the community level, since CHWs usually conducted HIV and MNCH tasks separately. The systems of supervision, reporting, and management also remained siloed at higher levels of the health system.

Conclusion

This research improves understanding of the feasibility, acceptance, and adoption of a newly integrated CHW program model. Workload, task complexity, and remuneration are important considerations in making CHW program design decisions. Integrated services require more time and effort to perform and carry a wider range of responsibilities, but can result in benefits for both clients and providers. As Tanzania moves forward with scaling up their national CHW cadre, implementation research should continue to assess realistic workloads in order to sustain motivation and prevent CHW burnout.

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Abbreviations

AIDS	Acquired Immune Deficiency Syndrome
ANC	Antenatal Care
ARI	Acute Respiratory Infection
ART	Antiretroviral Therapy
CBHP	Community Based Health Program
CHW	Community Health Worker
CHMT	Community Health Management Team
CSO	Civil Society Organization
CTC	Care and Treatment Center (for HIV/AIDS)
DC	District Council
DHS	Demographic and Health Survey
DHIS2	Demograhic Health Information System 2 (a software)
HBC	Home-based Care for HIV
HIV	Human Immunodeficiency Virus
HMIS	Health Management Information System
IDI	In-depth Interview
IRB	Institutional Review Board
ITS	Interrupted Time Series
LTFU	Loss to Follow Up
MDG	Millennium Development Goals
MNCH	Maternal, Newborn, and Child Health
MoHCDGEC	Ministry of Health, Community Development, Gender, Elderly, Children
MoHSW	Ministry of Health and Social Welfare
MUHAS-JHU	Muhimbili University of Health and Allied Sciences – Johns Hopkins University
PEPFAR	President's Emergency Plan for AIDS Relief
PMTCT	Prevention of mother-to-child transmission of HIV
PNC	Postnatal Care
RCH	Reproductive and Child Health
TZS	Tanzanian Shilling
USAID	United States Agency for International Development
VHW	Village Health Worker
WHO	World Health Organization

Chapter 1 Introduction

The World Health Organization (WHO) defines a health system as "all actors, institutions and resources that undertake health actions–where a health action is one where the primary intent is to improve health" (WHO, 1948). The health workforce is one of WHO's six "building blocks" essential to basic health system functioning, as well as critical to achieving the goals of universal health coverage (WHO, 2007; WHO and GHWA, 2013). There is a severe global shortage of health workers that has been caused by a variety of factors, including geographic maldistribution, skill mix imbalance, limited training capacity, migration to urban areas and higher income countries, low retention, and difficult work environments (WHO, 2006; Murphy *et al.*, 2014). The health workforce crisis limits delivery of high quality health services, which require adequate numbers of qualified health workers in the right place at the right time doing the right thing (Toure *et al.*, 2013).

Health workers are one of the costliest components within a health system: Remuneration accounts for approximately a third (28.7%–33.2%) of the total government health expenditures in low and middle income countries (Hernandez-Peña *et al.*, 2013). Possibilities for task shifting have resulted from the health worker shortage, coupled with the need for increasing cost efficiency in health systems. The WHO refers to task shifting as "a process whereby specific tasks are moved, where appropriate, to health workers with shorter training and fewer qualifications" (WHO, 2008). Task shifting involves redistribution of tasks among health workforce teams, sometimes requiring creation of new cadres of health workers who receive training to perform a specific task (WHO, 2008). Task shifting is a mechanism which can improve access to health services in areas faced with health workforce shortages.

Rural communities in low and middle income countries disproportionately suffer from the health worker crisis, and usually lack adequate qualified health workers to provide essential health services (Toure *et al.*, 2013; Murphy *et al.*, 2014). Thirty-six African countries have less than the WHO recommended density of health workers needed, including an estimated shortage of 820,000 doctors, nurses, and midwives across the continent (Toure *et al.*, 2013). The persistent shortage has been a key driver supporting community health worker (CHW) programs, particularly in Africa

(Mogedal *et al.*, 2013). Over the last decade widespread interest has grown in revitalizing large-scale national CHW programs to support the Millennium Development Goals (MDG) and efforts to achieve universal health coverage (Campbell *et al.*, 2015).

Rationale

The United Republic of Tanzania faces a critical shortage in health workers and has responded with commitment to "revitalizing Community Based Health Care, increasingly supported by professional CHWs, to ensure that essential health promotion, health protection, and prevention activities are addressed in partnership with communities" (Tanzania MoHSW, 2015a). This study evolved through collaborative discussions in early 2015 with the national CHW Task Force and the Health Promotion Section of Tanzania's Ministry of Health and Social Welfare, hereafter called the Ministry of Health.[1] The research directive was broad: To explore innovations within existing CHW programs in Tanzania, seeking information to implement the rollout of the national CHW cadre. After discussions with several USAID-funded implementing partners already involved with innovative CHW programs, TUNAJALI II was selected for evaluation. Full details of the TUNAJALI II program and research questions are presented later. Case study and implementation research methods were used to assess the impact of incorporating maternal, newborn, and child health (MNCH) tasks with the workload of HIV home-based care volunteer CHWs. Results contribute to the implementation literature on CHW workload expansion from single to integrated roles. The study supports Tanzania's CHW Task Force in the design and rollout of a national CHW cadre.

Background and Literature Review

An Overview of Community Health Workers

Community health worker (CHW) is a term that broadly encompasses various types of community-based health cadres. The WHO characterizes CHWs as individuals who "should be members of the communities where they work, should be selected by the communities, should be

[1] Tanzania's Ministry of Health and Social Welfare (MoHSW) was renamed the Ministry of Health, Community Development, Gender, Elderly, and Children (MoHCDGEC) during 2016. Throughout this dissertation "Ministry of Health" is used.

answerable to the communities for their activities, should be supported by the health system but not necessarily a part of its organization, and have shorter training than professional workers" (WHO, 1989). CHWs are referred to by a diverse set of names, both across and within countries, such as: lay health worker, health extension worker, village health volunteer, home-based care volunteer, lady health worker, community health assistant, community health promoter, and health auxiliary. The diversity in CHW nomenclature is also reflected by the variation in implementation models, which differ in terms of training scope and duration, educational qualifications, work environment, volunteer or professionalized status, remuneration level, supervision, task profile, data tracking, referral linkage, and integration within the health system.

One defining characteristic of many CHWs is the provision of services within homes, villages, and/or at community gatherings (rather than in formal health facility settings), thereby serving as a link between the community and health facility (Perry and Crigler, 2014). The *One Million CHW* campaign highlights the critical role of CHWs in the delivery of effective community-based interventions as "a platform to extend health care delivery and improve health" (CHW Technical Task Force, 2011). However, the role of CHWs is not limited to service provision; they also function in health promotion and community participation and empowerment roles, thus making key contributions to the primary health care system.

The Declaration of Alma Ata in 1978 formalized primary health care as policy of member countries of the WHO (WHO and UNICEF, 1978). It also signaled international recognition of an important role for CHWs to support primary health care systems in achieving the goal of Health for All (Perry *et al.*, 2014). In responding to Alma Ata's call for community participation, several countries established CHW cadres to extend health care access to poor rural communities (Rifkin, 2014). During this era, CHWs became synonymous with primary health care (Mburu, 1994). More recent literature has proposed moving beyond the narrow focus on CHWs to consider a *community health system* as "the set of local actors, relationships, and processes engaged in producing, advocating for, and supporting health in communities and households outside of, but existing in relationship to, formal health structures" (Schneider and Lehmann, 2016). Through characterizing CHWs as a *sub-*

system within the primary health care system, there is recognition that a broad array of health system and community factors contribute to community health performance (Schneider and Lehmann, 2016).

There is growing evidence that CHW programs can improve child nutrition, reduce maternal and neonatal mortality, increase child immunization uptake, expand family planning access, and contribute to control of HIV, tuberculosis, and malaria (Lewin *et al.*, 2010; Perry *et al.*, 2014). Furthermore, recent systematic reviews have shown the cost-effectiveness of task shifting to CHWs in low and middle income settings, particularly for tuberculosis and HIV/AIDS care, in addition to suggestive cost savings for malaria, MNCH, and childhood illness programs, although the evidence is weaker (Vaughan *et al.*, 2015; Seidman and Atun, 2017).

Interest in leveraging the community health workforce to support the MDGs and universal health coverage has escalated in recent years, with mobilization of bilateral, multilateral, and private philanthropic investment in community health (WHO and GHWA, 2013; Campbell *et al.*, 2015; Schneider *et al.*, 2016). Global support for community health systems has played out through multiple channels over the last decade, including advocacy campaigns (*One Million CHWs*), online resource repositories (*CHW Central*), and partnership commitments to address the global human resources for health crisis (*Global Health Workforce Alliance*).

In an effort to address the health workforce shortage and strengthen linkages between the community and facilities, many countries have begun the process of revitalizing, formalizing, and/or expanding national CHW programs to support the primary health care system (Liu *et al.*, 2011). For example, both Ethiopia and Rwanda began formalization and expansion of their national CHW cadres over a decade ago, a health sector reform that is credited as a key factor in the accelerated MNCH progress in both countries (Karim *et al.*, 2013; Condo *et al.*, 2014). Tanzania has recently embarked on a similar Community Based Health Program (CBHP) strategy, as discussed in subsequent sections. This dissertation research was framed around questions of ongoing program and policy relevance to community health implementation in Tanzania.

Integration

While numerous definitions of *integration* have been put forth, there is no standard definition

within the health systems literature. Many terms are used interchangeably with integration, including *coordination*, *linkage*, *collaboration*, *alignment*, and *networks*, along with a variety of concepts such as *integrated care*, *integrated health services*, *coordinated care, continuum of care,* and *integrated delivery networks* (Shigayeva *et al.*, 2010). Most conceptual frameworks of integration in health systems view it "as a transformative change that may lead to a complete merger of organizations or a formalized collaboration of systems of governance, accountability or service delivery, often involving resource pooling" (Shigayeva *et al.*, 2010).

A decades-old debate over integrated ("horizontal", "comprehensive", "generalist") versus non-integrated ("vertical", "selective", "specialist") programming within the organization and delivery of health care persists today. Taylor and Jolly's seminal paper on the straw men of primary health care articulates the misleading polarizations between vertical versus horizontal, top-down versus bottom-up, and planned versus participatory approaches, concluding that elements from each are generally needed (Taylor and Jolly, 1988). In making Alma Ata a reality, Walley et al. suggest that, "the emphasis has to shift from showing immediate results from single interventions to creating integrated, long-term, sustainable health systems…" (Walley *et al.*, 2008). Atun et al. (2010) have argued that the binary terminology of integrated/not-integrated presents a false dichotomy, and that interventions generally fall on a continuum of complexity with great variability in the level and type of integration. As such, more flexibility is proposed in designating programs as fully integrated, partially integrated, or not integrated.

Resource constraints in low- and middle-income countries are a notable driver in the push for integration, but there is also an intuitive expectation that integration will contribute to sustainable health systems by producing synergistic effects (Atun *et al.*, 2010; Shigayeva *et al.*, 2010; Shigayeva and Coker, 2015). Potential operational benefits might include efficiency gains in service delivery, increased access to services, convenience for clients, and decreased costs to both providers and clients (Shigayeva *et al.*, 2010; Lindegren *et al.*, 2012). Integration has been viewed positively in the health systems literature, with several possible benefits postulated such as "it reduces fragmentation or duplication of services, improves patient care outcomes and results in greater satisfaction with

services, offers benefits to overall population health, and improves the performance of health systems, their programmes and services" (Shigayeva *et al.*, 2010). A more recent justification for integration comes from literature on people-centered health systems, which emphasize close to community care and responsiveness, so that people's needs are considered in the design and delivery of health care services (Sheikh *et al.*, 2014).

In Tanzania, the CBHP Policy Guidelines define integration as "combining health care services and components of health care services that are currently delivered and/or managed separately, for the purpose of optimizing the use of scarce resources, maximizing coverage of services, and improving health outcomes" (Tanzania MoHSW, 2014a). In this dissertation, integration is conceptualized in terms of integrated services delivered by CHWs at the community/household level, and does not necessarily encompass integration at the reporting, supervision or management levels (perhaps, more accurately characterized as partial integration). While service delivery integration is often heralded as an 'uncomplicated good', that may not be the case if related managerial or supervisory systems are not conducive to integration. The unintended consequences of integration should also be considered, and will likely vary depending on what is being integrated and for what purpose. For example, while integration may streamline health services for patients, it also could expand provider workload requiring more effort to coordinate services, which may affect quality of care, productivity, motivation, and program effectiveness. Similarly, increased community-based activities could have consequences on the workload for facility-based staff through increased demand for services and increased pressure to provide more oversight to community-based volunteer providers.

Integration of MNCH, family planning, and nutrition, with HIV services is recognized as an important strategy for reducing maternal and child mortality and reaching the MDGs. The Global Plan for elimination of mother-to-child-transmission of HIV calls for "leveraging synergies, linkages, and integration for improved sustainability" (Lindegren *et al.*, 2012). Given the wide array of health issues facing women and children, a model for community-based service integration is needed. However, service integration is generally thought of in the context of facility-based service delivery, rather than

within community settings. One clear exception is the integrated community case management (iCCM) strategy, a response to low care seeking at facilities, which has begun to raise overall awareness of an integrated approach to childhood disease management at the community level.

A systematic review of evidence for integration of HIV, MNCH, family planning, and nutrition identified 20 studies, only one of which was based at the community level (Creanga *et al.*, 2007; Lindegren *et al.*, 2012). Findings from the review suggested sufficient evidence that HIV/AIDS integration with MNCH, family planning, and nutrition was feasible to implement across a variety of contexts, with many studies documenting improvements in health coverage and outcomes. However, there was still a strong call for more rigorous research to address significant gaps in the evidence, such as comparison of outcomes in integrated versus non-integrated services (Lindegren *et al.*, 2012). The paucity of evidence for HIV-MNCH service integration at the community level was notable in the review.

CHW Role Expansion

There is continued debate about how many tasks a CHW can effectively perform within his or her scope of practice before quality and productivity begin to decline from work overload. Volunteer CHWs balance a variety of activities throughout the day, including income generating activities, and therefore may only spend a couple of hours per day on CHW-related tasks. This may be sufficient for single-disease oriented volunteers, but in an integrated model where CHWs are responsible for an increasing number of activities, more time and effort by volunteers may be needed to improve coverage of services. For example, a recent time-motion study in Morogoro, Tanzania documented that MNCH CHWs spent an average of five hours per week on CHW tasks, with only two hours spent on home visits (LeFevre *et al.*, 2015). At lower levels of volunteerism there is likely a lower opportunity cost, but when CHW roles expand with increased workloads, there is an increase in marginal cost, due to the increased time spent volunteering that cuts into the available time for income generating activities (Kasteng *et al.*, 2015). In Kenya, a CHW study found “the decision to provide volunteer time is sensitive to the total time spent volunteering. Adding new tasks to volunteering CHWs, including tasks that require a more proactive role of the CHWs, may alter the cost benefit

trade-off of volunteering and should be combined with workload assessment and re-evaluation of support and funding" (Kasteng *et al.*, 2015).

Jaskiewicz and Tulenko (2012) posit that CHW productivity is influenced by three interrelated factors: capacity (knowledge, skills and attitudes), motivation, and work environment (workload, organizational support, supplies). While capacity and motivation have been extensively covered in the literature, the importance of an enabling work environment to support and maximize CHW productivity has not been widely researched. Workload is one component of the work environment and can be thought of as the intersection of the number and organization of tasks with the number of households to cover in the geographic catchment area (Jaskiewicz and Tulenko, 2012). Assessment of the relationship between workload and prioritization of tasks is a relatively new area of research. Furthermore, efforts are needed to ensure that the workload is reasonable in relation to training qualifications and the incentives structure.

For volunteer CHWs, service integration might entail longer household visits to cover multiple health promotion topics. A study of community-based reproductive health agents in Ethiopia found that the integration of family planning with HIV services did not increase the overall volume of clients reached, as the agent had other daily tasks, such as agriculture, and a limited number of hours to devote to volunteer activities (Creanga *et al.*, 2007). Integration is advantageous to the client in terms of multiple types of service at one touchpoint, but integration also increases the amount of time spent with each client. Therefore, the overall number of reproductive health agents would need to increase for the program to maintain pre-integration outreach levels. Alternatively, if additional incentives were provided to volunteer CHWs tasked with expanded roles, this might offset the marginal cost of volunteering and increase the number of clients they could effectively reach. For example, a study in South Africa suggested that voluntary "lay counselors will most likely not implement additional interventions (on top of their already defined duties) without financial, structural or personnel assistance" (Peltzer *et al.*, 2010). This issue could affect acceptance, adoption and feasibility of the integrated model if additional incentives are not offered when the scope of work is broadened.

In a systematic review of intervention design factors influencing CHW performance, several studies examined the nature of CHW tasks and time spent on delivery of such tasks: Higher CHW performance was associated with a higher number of perceived responsibilities, flexibility in tasks, longer service delivery time, and more time spent on the job per week (Kok *et al.*, 2015). In Bangladesh, after treatment for severe acute malnutrition was added to the workload of CHWs focused on community case management of acute respiratory infection and diarrhea, they maintained quality of care for both preventive and curative tasks, despite reporting significantly more hours worked per week (Puett *et al.*, 2012). However, in Malawi, a qualitative study that explored task prioritization when CHWs had integrated responsibilities, identified several challenges: overloading with too many tasks and CHWs unable to fulfill multiple roles; specialization of tasks when CHWs received additional training on a specific skill, with over-emphasis on the new skill; and inadequate management of competing priorities, due to multiple programs and stakeholders (Smith *et al.*, 2014).

Country Context: Tanzania

Tanzania is a country in Eastern Africa, located just south of the Equator, bordered by the Indian Ocean to the East and eight countries: Mozambique and Malawi to the South; Zambia, Democratic Republic of Congo, Burundi, and Rwanda to the West; and Kenya and Uganda to the North (Figure 1). Tanzania was formed in April 1964 through the union of Tanganyika (Mainland Tanzania) with Zanzibar (Tanzania MoHCDGEC *et al.*, 2016b). Administratively, Mainland Tanzania is divided into 8 geographical zones consisting of 25 regions, which are further sub-divided into 160 districts or local government authorities, while Zanzibar is one geographical zone consisting of 5 regions and 10 districts (Tanzania MoHCDGEC *et al.*, 2016b). Rural districts are referred to as District Councils, whereas urban districts are referred to as either Town Councils, Municipal Councils, or City Councils.

Based on the most recent 2012 population census of 44.9 million, the 2016 projected population is estimated at 50.1 million (Tanzania National Bureau of Statistics, 2017). Globally, Tanzania ranks 24th in population, but given its large area of 950,000 square kilometers (km), is sparsely populated (51 persons per km^2) with the majority (70%) of the population rural-based

(Tanzania NBS and Zanzibar Office of Chief Government Statistician, 2013; United Nations, 2015). Demographic transition theory refers to the modernization process that countries undergo in moving from a pre-modern stage (high fertility and high mortality rates) to a post-modern stage (both rates declined to low levels) (Kirk, 1996). With a median age of 17.6 years and nearly two-thirds of the population less than 25 years old (44% 0-14 years; 20% 15-24 years), Tanzania's high crude birth and death rates (42 births / 1,000 population; 9.3 deaths / 1,000 population) signal that the country is still in the early stages of demographic transition (Tanzania NBS and Zanzibar Office of Chief Government Statistician, 2013).

Health profile

Maternal, newborn, and child health

One of Tanzania's most notable health achievements is its dramatic progress in reducing child mortality over the last 25 years. The under-5 child mortality rate was reduced from 141 to 67 deaths per 1,000 live births between 1991-92 and 2015-16, which resulted in meeting the MDG 4 target for child survival (Tanzania MoHCDGEC *et al.*, 2016a). Pneumonia, malaria, and diarrhea are the leading causes of death among children under-5, and neonatal deaths account for 40% of all under-5 deaths (Afnan-Holmes *et al.*, 2015). A recent case analysis suggests that national political prioritization and strong implementation of child health interventions were critical to Tanzania's child survival gains (Afnan-Holmes *et al.*, 2015).

Compared to child health, the pace of progress in reduction of neonatal and maternal mortality has been far slower. From 2000 to 2012, the neonatal mortality rate declined from 46 to 21 deaths per 1,000 live births, an annual rate of reduction of 4.3% (Countdown to 2015: Maternal Newborn and Child Survival, 2014). Similarly, the average annual reduction in the maternal mortality ratio (MMR) was 4.8% from 2000 to 2013, a decline from 770 to 410 maternal deaths per 100,000 live births. This pace was insufficient to achieve Tanzania's MDG 5 target for improved maternal health (WHO, 2015a). The 2015-16 Demographic and Health Survey (DHS) estimated a MMR of 556 maternal deaths per 100,000 live births, which was not significantly different from the 2012 census (432), nor the 2010 DHS (454) or 2004-05 DHS (568) – suggesting the MMR has not changed

substantially over the last 10 years (Figure 2). (Tanzania MoHCDGEC *et al.*, 2016b). Intrapartum-related events and preterm birth complications are the leading causes of newborn deaths, while hemorrhage, hypertension, sepsis, and unsafe abortion are the leading causes of maternal deaths in Tanzania (Afnan-Holmes *et al.*, 2015).

During pregnancy, nearly all women attend at least one antenatal care visit, but only a quarter of women attend their first antenatal care visit during the first trimester, while the coverage rate for the recommended 4 or more antenatal care visits is only 51% (Tanzania MoHCDGEC *et al.*, 2016b). Nationally, a skilled birth attendant at delivery (64%) and utilization of postnatal care (37%) remains low, with the break in continuity from pregnancy to delivery to postnatal care further contributing to the slow progress in maternal and neonatal mortality reduction (Mohan *et al.*, 2015; Tanzania MoHCDGEC *et al.*, 2016a).

Globally, Tanzania has one of the highest total fertility rates with an expected 5.2 children born per woman during her childbearing years (Tanzania MoHCDGEC *et al.*, 2016b). Roughly one in four married women age 15-49 report using contraception (32% modern method; 6% traditional method), while over half of unmarried sexually active women age 15-49 report using contraception (46% modern method; 8% traditional method) (Tanzania MoHCDGEC *et al.*, 2016b). The 22% unmet need for family planning among married women suggests increased access to services are needed. Differences in family planning utilization are notable by socioeconomic status, with higher rates of contraception use among urban dwellers, secondary school educated, and those in the highest wealth quintile (Tanzania MoHCDGEC *et al.*, 2016b). To accelerate reduction of neonatal and maternal mortality in Tanzania, an increased focus on newborn care, family planning, and abortion care has been advised (Afnan-Holmes *et al.*, 2015).

HIV/AIDS

Tanzania's burden of mortality and morbidity is largely attributable to communicable diseases. In 2015 HIV/AIDS, lower respiratory infections, malaria, and diarrheal disease were among the top five causes of death and disability (IHME, 2015). The infectious disease burden of HIV/AIDS places an enormous strain on the health system and in 2012 was the leading cause of death among

adults, killing 73,400 Tanzanians (WHO, 2015b). The HIV prevalence in Mainland Tanzania has declined over time from 7.0% (2003-04) to 5.8% (2007-08) to 5.3% (2011-12), but continues to disproportionately affect women (6.3%) compared to men (3.9%), as measured most recently in 2011-12 (Figure 3) (Tanzania NBS, 2013). There has been a substantial increase in HIV testing, but nearly half of adults remain untested. The self-report of HIV test with result receipt among adults age 15-49 increased between 2008-2012 from 37 to 62% (women) and 27 to 47% (men) (Tanzania NBS, 2013).

Tanzania has made progress in prevention of mother-to-child transmission (PMTCT) of HIV. In 2015, 86% of pregnant women living with HIV in Tanzania accessed antiretroviral therapy (ART) for PMTCT (UNAIDS, 2016). Since 2009, Tanzania has reduced new pediatric HIV infections by 69% to 6,500 new infections annually and reduced new infections in women (age 15-49) by 33% to 26,000 new infections annually (UNAIDS, 2016). Tanzania's 2010 DHS indicated that 72% of women and 62% of men were aware that breastfeeding can transmit HIV to infants *and* that ART can reduce the risk of transmission, a substantial improvement over the 2005 DHS knowledge levels of 29% women and 30% men (Tanzania NBS and ICF Macro, 2011). However, the estimated HIV transmission rate (8%), including during breastfeeding, suggests that higher retention in care and provision of ART throughout the breastfeeding period is an urgent priority (UNAIDS, 2016).

Historical context of Tanzania's health system and health workforce

Following Tanzania's independence in 1961, the national health system was established explicitly to provide decentralized health care to the vast rural-based population through establishment of rural health dispensaries (Kwesigabo *et al.*, 2012). The Arusha Declaration of 1967, a political statement on socialism and self-reliance, signaled government commitment to increasing health equity through universal access to free health services by marking the beginning of Tanzania's restructuring of health care delivery towards primary health care (Heggenhougen *et al.*, 1987). The Arusha Declaration also renewed the central government's effort to mobilize resettlement of the rural-based population into 'Ujamaa' villages (Heggenhougen *et al.*, 1987). The compulsory "villagization" campaign from 1973 to 1976 was considered a form of "development welfare" with the resulting village settlement patterns affording the state a more efficient means for developing schools and

health clinics and delivering clean water (Scott, 1999). By 1978, nearly 90% of rural villages were located within 10 kilometers of a health facility (White *et al.*, 2013).

Tanzania is considered to be among the first countries to have developed and implemented a vision for primary health care following the 1978 Declaration of Alma Ata (Advancing Partners & Communities, 2013). As a result of early and continued investment in the rural health system, the density of health facility infrastructure in Tanzania is among the highest in Africa (Ramsey *et al.*, 2013). Dispensaries (6,000-10,000 catchment), health centers (50,000 catchment), and hospitals serving the entire district catchment area comprise the decentralized structure of Tanzania's formal health system (Figure 4) (Kwesigabo *et al.*, 2012). As of 2013, there were 5,913 dispensaries, 711 health centers, 219 district level hospitals, 25 regional referral hospitals, and 8 national zonal and specialized hospitals (Tanzania MoHSW, 2014b).

During the late 1960s, there were ad hoc efforts to train village-based CHWs, since establishing dispensaries within each village was not possible (Heggenhougen *et al.*, 1987). These initial CHWs were selected by villagers to receive 3 to 6 months of training at nearby health centers and hospitals, but were never paid a salary or formally included in the government health system (Heggenhougen *et al.*, 1987). Many years later, in 1983, the Village Health Worker (VHW) program was formally launched as part of a national primary health care initiative (Heggenhougen *et al.*, 1987). The VHW program focused on community health education, preventative health services, and care for minor ailments, serving as a referral link between the community and health dispensary (Kwesigabo *et al.*, 2012; Advancing Partners & Communities, 2013). However, the VHW program faced several implementation constraints: low retention, lack of supervision support, inadequate remuneration, drug shortages, and transportation issues (Heggenhougen *et al.*, 1987). Community expectations that VHWs should focus exclusively on curative services, rather than health education and promotion activities, was a further barrier to program success (Heggenhougen *et al.*, 1987). Expansion of child survival programs throughout the 1980s temporarily addressed some of the early constraints, but the project-based structure limited sustainability (Ramsey *et al.*, 2013). In the 1990s government funding waned and the VHW program was gradually replaced by an informal network of vertical, disease-

specific CHW programs operated and supported by an array of partner organizations (Advancing Partners & Communities, 2013). Former VHWs have generally been hired by these partner organizations, where they receive a nominal monthly stipend for their volunteer services (Advancing Partners & Communities, 2013). Vertical, single-disease oriented training is periodically administered by the partners, but generally no further training support is provided on the wider primary health care scope, which previously had formed the basis of the national VHW program (Ramsey *et al.*, 2013).

Tanzania's human resources for health shortage undermines efforts to improve equity in health care access in rural areas. Growth in the health workforce has not kept pace with the population growth (Kwesigabo *et al.*, 2012). As of 2012, Tanzania reported a skilled health workforce density of 5.9 per 10,000 population, improved from the density of 3.3 per 10,000 in 2005 (Mboera *et al.*, 2015). According to Tanzania's current Human Resources for Health Strategic Plan (2014-2019), a minimum of 145,454 health care workers are needed to provide quality health services at Tanzania's 6,876 health facilities; yet, only 63,447 health care workers are available, equating to a 56% shortage across Tanzania (Tanzania MoHSW, 2014b). A geographic maldistribution of health workers persists, with urban districts averaging three times the number of health care workers per capita compared to rural districts (Munga and Maestad, 2009; Kwesigabo *et al.*, 2012; Munga *et al.*, 2014). Dispensaries are most severely affected by the maldistribution of HCWs, as roughly 10% of the 5,913 dispensaries are not staffed by any skilled health workers (JAHSR 2014 - BRN Healthcare Briefing, 2014; Tanzania MoHSW, 2014b). Several other factors also limit the capacity of Tanzania to effectively respond to its health need. These include: unreliable drug and supply stocks, lack of equipment, low motivation among health care workers, inadequate referral networks, poor transportation, and insufficient communication infrastructure (Kwesigabo *et al.*, 2012).

The Community Based Health Program

A vast network of 41,000 CHWs working across 44 programs supports Tanzania's health system. A landscaping analysis of these CHW programs revealed several key findings: widespread regional variability in distribution of CHWs; a majority of CHWs were volunteers provided with a stipend allowance; half of CHWs had knowledge of HIV/AIDS and nearly 40% had knowledge of

family planning and reproductive health; CHW training varied from 3 days to 9 months, depending on the program; and only 1 in 4 CHWs had Form 4 secondary school education, required for application to the national CHW cadre (MUHAS and JHSPH, 2015). These volunteers are generally coordinated by implementing partners and non-governmental organizations, and their training and tasks are typically vertically focused on a single health area.

Revitalization of a national community based health care program in Tanzania was supported by the growing recognition that a lack of coordination and harmonization across numerous partner-operated CHW cadres was hindering progress. In July 2012, the Health Promotion Section of the Ministry of Health felt it imperative "to solicit ideas from different stakeholders on how best CHWs could be coordinated, remunerated, and trained to promote community health in a sustainable, affordable, and effective way, in line with policy guidance which does promote CHWs as part of Tanzania PHC strategy" (Van Praag, 2017). The National CHW Task Force formed in 2013 to advise the Ministry of Health on community-based health services and support policy development. It includes a diverse set of stakeholders from the Ministry of Health, donors, academia, and development partners. The CHW Task Force has supported establishing a national, standardized CHW cadre with an integrated scope of work, and it has also coordinated several publications, including the CBHP Policy Guidelines (February 2014); CBHP Strategic Plan (March 2014); CBHP Training Curriculum (June 2015); and CBHP Program Design Guidelines (January 2017).

Selection criteria for the national CHW training program requires that an applicant is at least 18 years of age and a resident of the locality, be nominated by the village assembly, and has a minimum of Form 4 education (secondary school), including a pass in biology (Tanzania MoHSW, 2014c). Form 4 is a non-negotiable requirement for employment within Tanzania's government system. The new national CHW cadre is trained for nine months on an integrated scope of work. The CHW curriculum is aligned with the components of the National Essential Health Package: reproductive and child health services; communicable disease control; non-communicable disease control; nutrition; common diseases of local priority; community health, promotion and disease prevention; environmental health, hygiene and sanitation; social welfare and social protection; and

emergency preparedness (Tanzania MoHSW, 2014c). The pilot class of 3,737 CHWs graduated in November 2016 and a second class of 6,000 CHWs is currently undergoing training (Gowelle, 2017).

As the rollout of the national CHW cadre is still in its early stages, the CHW Task Force has called on stakeholders and partners to support ongoing research and evaluation needs in critical areas such as recruitment, training, deployment, and supervision of CHWs. Since 2013, Muhimbili University of Health and Allied Sciences (MUHAS) in Dar es Salaam, Tanzania, and Johns Hopkins Bloomberg School of Public Health (JHU) in Baltimore, Maryland, have been collaborating with the Ministry of Health to provide research support. The Community Health Workers Learning Agenda Project (CHW LAP) was a multiyear implementation research partnership between MUHAS-JHU spearheaded by the principal investigators Dr. Japhet Killewo (MUHAS) and Dr. Abdullah Baqui (JHU). As a PhD student investigator under CHW LAP, I supported an evaluation of an innovative CHW model in Iringa, Tanzania through development of the research questions and study protocol, IRB documents, interview guides, data collection tools, and training materials. I was also responsible for management of data collection in Iringa, data processing and cleaning, and all data analyses specific to the research questions, outlined below in "Research Overview", which comprised this dissertation.

Big Results Now Initiative

In parallel with the Ministry of Health plans for a national CHW cadre, the President's Delivery Bureau in Tanzania is coordinating a multisectoral development initiative called *Big Results Now*. This initiative was launched in 2013 with the goal of moving Tanzania into Lower Middle Income Country status by 2025, focusing government implementation efforts across multiple sectors (Mwakyusa, 2014). *Big Results Now* utilizes priority setting, focused planning, efficient resource management, and monitoring and evaluation (Tanzania MoHCDGEC *et al.*, 2016b). Within the health sector, *Big Results Now* aims to accelerate improvement in performance management, health commodities, human resources for health distribution, and MNCH outcomes (JAHSR 2014 - BRN Healthcare Briefing, 2014). Five low-performing regions in Tanzania's Northwestern Lake Zone have

been targeted for *Big Results Now* improvement in MNCH: Geita, Kigoma, Mara, Mwanza and Simiyu Regions.

Big Results Now plans are underway to mobilize CHWs to extend MNCH services and increase community awareness of MNCH issues. CHWs previously trained on a variety of disease-specific focal areas (e.g. malaria, HIV/AIDS, TB, or family planning), and who have Form 4 education qualifications, will be selected to receive a three-week training program using the Ministry of Health approved integrated MNCH curriculum for CHWs. The MNCH curriculum was developed in 2009 through a partnership between Jhpiego and the Ministry of Health. It focused on promoting the importance of attending routine antenatal, delivery, and postnatal visits, as well as some key health behaviors during the antenatal and postnatal periods. Of note, this MNCH curriculum was used in the present study to train HIV-focused CHWs in Iringa and has also been incorporated into the curriculum for the national CHW cadre.

The Ministry of Health and CHW Task Force have forged ahead with the national transition to a formalized, professional CHW cadre. Meanwhile, a simultaneous directive from the President's Delivery Bureau calls for targeted investment in the *Big Results Now* Northwestern Lake Zone to retrain volunteer CHWs in MNCH services. The Health Promotion Section of the Ministry of Health is responsible for management of both processes, and needs to find ways to link the two agendas in complementary ways.

Research Overview

MUHAS and JHU worked with the CHW Task Force to identify USAID-funded program models with innovative designs that could be of interest to the development plans for the national CHW cadre. This dissertation evaluates an innovation introduced to a volunteer CHW program in Iringa Region, called TUNAJALI II, which established an integrated CHW cadre focused on both HIV and MNCH health promotion. The following sections describe the research questions, conceptual framework, and provide further detail on the study setting and context of the TUNAJALI II program.

Research Aim and Questions

The overall aim of this research is to characterize the implications of establishing an integrated CHW program in Iringa Region. Implementation research seeks to "understand and work within real world or usual practice settings, paying particular attention to the audience that will use the research, the context in which implementation occurs, and the factors that influence implementation" (Peters *et al.*, 2014). Within this aim, several implementation research questions were evaluated:

> **Question 1**: Does a dual role CHW model affect the number of HIV visits conducted per month compared to a single role model?
>
> **Question 2**: Does a dual role CHW model affect the number of monthly institutional deliveries?
>
> **Question 3**: What are the perspectives on feasibility, acceptance, and adoption of the integrated HIV-MNCH model?
>
> > **Sub-Question 3a**: How do CHWs balance and/or prioritize HIV versus MNCH tasks in their volunteer activities, if at all?

Conceptual Framework

The conceptual framework guiding the research approach was based on a logic model whereby the pathway of program inputs is related to processes, outputs, and intended outcomes (Figure 5). Taking the existing longstanding HIV home-based care, there were several key inputs and intermediate processes to establish the dual role CHW model, including:

- Three-week MNCH training curriculum.
- Increased monthly stipend from 35,000 to 40,000 Tanzanian Shillings.
- Additional supervision (dedicated facility-based MNCH supervisor).
- Additional register and submission of monthly MNCH household visit report.

The blue boxes indicate measures that were quantitatively assessed, while green boxes indicate qualitative assessment.

Research questions #1 and #2 address whether CHWs could balance HIV and MNCH household visits and if there were subsequent changes at the facility-level in MNCH service utilization (attributable to the integrated CHW model). The number and type of household visits as well as prioritization and organization of tasks are outputs assessed following integration of

HIV and MNCH task. The balance of HIV and MNCH tasks, including prioritization, may be influenced by CHW covariates, including: age, sex, education level, years of CHW experience, distance from home to the health facility, and other income generating activities. Education level is of particular interest, given the new policy requiring recruitment of candidates with at least a Form 4 education into the national CHW cadre. Additional important factors that may influence CHW performance are beyond the scope of this research, such as CHW motivation, knowledge, skills, self-efficacy, quality of care, and availability of supplies (Jaskiewicz and Tulenko, 2012; Kok *et al.*, 2015).

Research question #3 explores perspectives on program feasibility, acceptability, and adoption of the integrated CHW model. These implementation outcomes are intermediate to the end goals of increased service utilization and improved health outcomes. They are defined as (Peters *et al.*, 2013):

- **Feasibility**: "the extent to which an intervention can be carried out in a particular setting or organization" (practicality, actual fit, utility, suitability for everyday use)
- **Acceptance**: "the perception among stakeholders that an intervention is agreeable" (acceptability, comfort, relative advantage, credibility)
- **Adoption**: "the intention, initial decision, or action to try to employ a new intervention" (uptake, utilization, intention to try).

This question also explores perspectives on how CHWs prioritize their time, if at all, across HIV and MNCH activities.

Rogers (2003) diffusion of innovation theory describes conditions that serve to increase or decrease the likelihood that a social system will adopt an innovation. Within public health and health systems research, it is a widely used theory to frame inquiry into community processes and social factors influencing stakeholder perceptions (Nanyonjo *et al.*, 2012; Zulu *et al.*, 2015). Several attributes of the theory (relative advantage, compatibility, and complexity) helped guide in-depth qualitative inquiry into the feasibility, acceptance, and adoption of the integrated CHW model. An innovation is more likely to be accepted if perceived to be better than previous options

(relative advantage), consistent with the values, needs, and experience of the adoption system (compatibility), and easy to use and understand (complexity) (Rogers, 2003).

TUNAJALI Program

Background

From 2006 to 2011, the United States Agency for International Development (USAID) and the President's Emergency Plan for AIDS Relief (PEPFAR) supported a $56 million initiative in Tanzania to prevent HIV/AIDS and increase access to HIV care and treatment, called TUNAJALI (Swahili for "we care"). Deloitte Consulting Limited (hereafter Deloitte) was the prime partner leading financial and grants management, while Family Health International served as the lead technical partner for HIV care and treatment. TUNAJALI focused on both community and facility-based services to ensure quality of HIV care and treatment. At the facility level, the HIV/AIDS Care and Treatment project aimed to rapidly increase and sustain access to ART. At the community level, the Home-based Community Care for People Living with HIV/AIDS and Orphans and Vulnerable Children (HBC/OVC) initiative sought to deliver support services to HIV/AIDS-affected households by leveraging CHWs and hiring patient tracking coordinators to strengthen linkages between the facility and community. Patient tracking coordinators worked onsite at high volume facilities where they liaised with HIV care and treatment center (CTC) staff to identify HIV patients lost to follow-up (LTFU) and link them to CHWs for home-based tracking (PEPFAR, 2007; FHI 360 and Deloitte, 2012).

In 2012, USAID and PEPFAR funded a five-year, $103 million initiative (TUNAJALI II) to build upon the achievements of the initial TUNAJALI program through further scale up of comprehensive clinical and community based HIV/AIDS services, ensuring a locally driven response to the epidemic. Deloitte continued to serve as the prime partner for TUNAJALI II providing overall program management and strategic leadership, while the Christian Social Services Commission provided technical leadership.

Additional funding was disbursed to the TUNAJALI II program in 2014 to support integration of MNCH services into the PMTCT platform in Iringa and Morogoro Regions, with a goal of increased utilization of antenatal care and health facility deliveries. Deloitte recommended HIV-focused CHWs could absorb additional MNCH responsibilities, instead of creating and funding a separate cadre of MNCH-focused volunteers. The basis for their recommendation was two-fold: observation that increased HIV treatment coverage and compliance has reduced HIV workload of CHWs due to a reduction in the number of extremely sick HIV patients in need of palliative services; and the perceived benefits of integrating HIV and MNCH services by CHWs. This dissertation centers on Deloitte's adaptation to the CHW model in Iringa Region, where existing HIV-focused volunteers were trained on MNCH to establish an integrated HIV/MNCH scope of work at the community level.

Study Setting

Iringa Region is located in Tanzania's Southern Highlands, roughly 500 kilometers southwest of Dar es Salaam, the largest city and commercial capital. The population of 941,238 (52% female) mostly resides in rural areas (73%) where the majority (81%) work as farmers (Tanzania NBS, 2012). The region serves as a main transport hub due to the Tanzam highway that runs through Iringa and connects Dar es Salaam and Zambia. Iringa is comprised of five districts, including two urban councils and three rural councils. This research was conducted in two of the rural districts: Iringa Rural and Kilolo.

Iringa Region has outperformed the national level estimates for several key MNCH indicators (Table 1). For example, in the 2015-16 DHS, 93% of women reported delivery at a facility and 72% of women reported a PNC checkup within two days, far above the national averages of 63% and 32%, respectively (Tanzania NBS and ICF Macro, 2011; Tanzania MoHCDGEC *et al.*, 2016b). The total fertility rate in the Southern Highlands (4.3) was slightly lower than the national estimate of 5.2 (Tanzania MoHCDGEC *et al.*, 2016b). The HIV prevalence (9.1%) in Iringa Region is the second highest in the country and nearly double the

national average (5.1%), disproportionately affecting women (10.9%) compared to men (6.9%) (Tanzania Commission for AIDS *et al.*, 2013).

In 2014, Iringa Region had the country's second highest density of skilled health workforce (8.3 per 10,000 population) as well as the highest facility density (3.1 per 10,000 population) which was nearly double that of mainland Tanzania (Armstrong *et al.*, 2016). The density of facilities in Iringa is a likely determinant of the high facility delivery coverage (Straneo *et al.*, 2016). Deloitte is one of eight partners supporting approximately 1,200 CHWs in Iringa Region, with programs covering general social work and a variety of disease specific areas, including PMTCT, MNCH, HIV, TB, harm reduction, and malaria (JHU and MUHAS, 2014).

CHW Program Description

Deloitte works with three civil society organizations to implement the home-based care CHW program in Iringa Region, supporting 434 volunteer CHWs across four of the five district councils. CHWs were previously trained for 12 days and primarily tasked to provide support services to HIV patients and their families. These include: nursing care, feeding, nutritional care and support, pain management, spiritual and emotional support, prevention of opportunistic infections, linkage to health care services, support for adherence maintenance and clinic visit schedules, and tracking HIV patients who missed appointments (defaulters) (Table 2). The widespread availability of ART has greatly reduced the need for in-home palliative support services for very sick HIV/AIDS patients, so that CHWs currently focus on linkage to health services, adherence support, and defaulter patient tracking.

There are generally one to two HIV-focused CHWs per village, each responsible for 15 to 100 households in their catchment. CHWs can be linked with dispensaries, health centers, or hospitals, where they liaise with a facility-based supervisor and a civil society organization-based focal person. On a monthly basis, the civil society organizations organize a meeting with their respective CHWs. At these meetings, each CHW submits a monthly HIV report with household visit data and discusses challenges and successes in the previous month. The facility-based

supervisor and district home-based care coordinator are invited to attend these meetings. CHWs are also responsible for submitting their monthly HIV report to their facility-based supervisor.

Intervention: HIV and MNCH Integration

During June and November 2015, Deloitte trained approximately half of the existing HIV-focused CHWs in Iringa Region using the Ministry of Health approved three-week MNCH curriculum, thereby establishing an integrated dual role CHW model focused on both HIV and MNCH (compared to "single role" CHWs focused on HIV-only). Deloitte selected CHWs for MNCH training, without explicit criteria or input from the managing local civil society organizations. The lack of randomization of the intervention potentially introduced selection bias, meaning CHWs chosen to receive additional MNCH training could be different from CHWs not chosen to receive the MNCH training. Selection bias can result in an over- or under-estimate of the true effect of the intervention. A comprehensive set of demographic and facility covariates were collected to examine similarities across the intervention and comparison group of CHWs, and to minimize the effect of selection bias through controlling for any potential differences.

MNCH training consisted of two weeks of classroom and one week of practicum sessions. The MNCH curriculum covered a variety of health promotion topics, organized around the timing of home visits (Table 3) (Tanzania MoHSW, 2012). These included: antenatal care booking, pregnancy danger signs, nutrition, birth preparedness, breastfeeding, malaria prevention, HIV/AIDS, PMTCT, gender issues, family planning, newborn care, newborn danger signs, infection prevention, and postpartum care and changes in the mother. CHWs were instructed on the recommended frequency and timing of MNCH visits, including at least three home visits during pregnancy, seven home visits postpartum, three home visits for newborns the first week, followed at three and five weeks, three and five months, and quarterly every year until the child turns five years old. CHW supervision was separately provided by a facility-based health care worker for HIV and MNCH, with additional monthly support from "focal persons" based at the civil society organizations.

A monthly stipend was provided to CHWs, which increased from the initial 30,000 Tanzanian Shillings (~$17 USD) to 40,000 Tanzanian Shillings (~$20 USD) for all CHWs following MNCH training, regardless of single or dual responsibilities. It is unclear whether the extra 5,000 Tanzanian Shillings will be viewed as sufficient incentive to take up additional MNCH tasks. For comparison, Tanzania's gross national income in 2015 was $77 per month per capita, or $920 annually (The World Bank, 2016). The 2011/12 Household Budget Survey indicated a basic needs poverty line of 36,482 Tanzanian Shillings per adult per month – meaning the minimum income required to satisfy resource consumption necessary for long-term physical wellbeing – a line that 28% of the Tanzanian population fell below (Tanzania National Bureau of Statistics, 2013a).

District Sampling

This case study focused on two of the four districts where TUNAJALI II was implemented: Iringa Rural and Kilolo. Mufindi was excluded based on an ongoing initiative, the Partnership for HIV-Free Survival, which may have shifted program implementation toward a PMTCT-focus. Iringa Municipal was excluded because of its urban setting that is less relevant to the national CHW cadre, which will be largely rural-based. Within each district, there are a mix of government, faith-based, and privately-run dispensaries, health centers, and hospitals. (Table 4). A majority of facilities in Iringa Rural (57%) and Kilolo (59%) were involved in the CHW program supported by the civil society organizations and TUNAJALI II, meaning single and/or dual role CHWs reported to the facility for supervision and data monitoring.

What is Integrated?

During July 2015, the MUHAS-JHU research team held informal discussions with Deloitte and key civil society organization staff in Iringa Region to gain a high-level overview of program implementation. The meetings helped to map out data flow and supervision processes for the HIV and MNCH focal areas, which were later confirmed during the data collection phase (Figure 6). Supervision and management systems for the integrated CHW model were kept

largely separated by HIV and MNCH domains. By program design, dual role CHWs report to both HIV and MNCH supervisors, usually located at the same facility. Infrequently, dual role CHWs report to HIV and MNCH supervisors at separate facilities. At some facilities, the MNCH-focused supervisor provides support on both HIV and MNCH tasks. A focal person from the civil society organization also provides supervisory support to CHWs for HIV-related tasks.

Reporting and data monitoring also remained separate by program design. All CHWs submitted a monthly HIV summary report to their facility-based HIV supervisor, with a copy to their civil society organization focal person. Additionally, dual role CHWs submitted a monthly MNCH summary report to their facility-based MNCH supervisor, but ***not*** to the civil society organization. Side by side examination of HBC and MNCH data reports was intended to occur at the level of the facility in-charge, prior to sending the CHW reports for HIV and MNCH to the District Medical Office.

Atun et al. (2010) define health interventions as "combinations of technologies, inputs into service delivery, organizational changes and modifications in processes related to decision making, planning, and service delivery." In this context, the three-week MNCH training established an integrated HIV-MNCH model by modification to service delivery processes at the community level. While dual role CHWs will focus on both types of HIV and MNCH health promotion tasks, in an integrated manner where appropriate, the management, supervision, and data reporting processes were not integrated across HIV and MNCH domains. As such, this program could be classified as 'partially integrated' (Atun *et al.*, 2010).

Methodological Approach

Epistemology

Epistemology is a branch of philosophy which examines the nature of knowledge (Merriam-Webster, 2017), or ways of knowing and understanding a phenomenon. This research followed a pragmatic epistemology, which draws from the late 19th century and early 20th century

writing of philosophers Charles Pierce and John Dewey, who prioritized experience in improving understanding of truth and driving inference (Hookway, 2016). Pragmatism is commonly understood to prioritize research problems, using multiple methods of data collection and analyses to best understand the problem, while also recognizing the importance of the social, cultural, political, and historical context within which the research occurs (Creswell, 2014).

Case Study Research

A prospective, mixed methods case study design was carried out. A case study is a type of research inquiry defined in two parts (Yin, 2014). Part I refers to the *scope* of the case study, an "empirical inquiry that investigates a contemporary phenomenon (the 'case') in-depth and within its real-world context, especially when the boundaries between phenomenon and context may not be clearly evident" (Yin, 2014). The importance of *context* in case study research distinguishes it from other approaches, such as survey research (context limited by the number questions and depth of responses) and experimental research (context controlled by design features such as randomization) (Yin, 2014). Part II relates to the *features* of the case study inquiry, with more variables of interest than data points, given the complexity of the phenomenon (the "case" is a single data point) (Yin, 2014). As such, it requires reliance on triangulation of evidence from multiple sources of data. Three conditions lead to more variables of interest than data points in a case study: in-depth inquiry, exploration of contextual conditions, and the study of conditions over time (Yin, 2014).

Case study research is ideal for in-depth analysis of the "*how*" and "*why*" of research questions related to the study of contemporary complex systems (Yin, 2014). The case unit of analysis is TUNAJALI II's integrated CHW model, introduced in Iringa Region during 2015. A single case design, with multiple units of analysis, contributes to knowledge and theory building, through either challenging, confirming, or extending a working hypothesis (Yin, 2014). Our underlying hypothesis is that integration will alter CHW workload and may influence CHW prioritization of activities, which could influence feasibility, acceptance, and adoption.

Mixed Methods Design Overview

Mixed methods research has been described as particularly suitable to implementation research, "a practical way to understand multiple perspectives, different types of causal pathways, and multiple outcomes—all common features of implementation research problems" (Peters *et al.*, 2014). A QUAL-QUAN design, with equal weighting across the two paradigm approaches was utilized (Figure 7) (Tshakkori and Teddlie, 1998). Data was collected during multiple phases from February 2016 through January 2017. The initial phase of qualitative data collection drew upon descriptive and exploratory inference through key informant interviews describing implementation and exploring perspectives on CHW workload and program feasibility, acceptance, and adoption. Concurrently, quantitative demographic information was collected from CHWs. Phase II drew upon influence-plausibility inference, using an interrupted time series to assess changes in CHW household visits (HIV and MNCH) and facility delivery utilization.

While each phase of research could stand alone, the strength of the mixed methods design drew from analytical triangulation, which "seeks convergence, corroboration, correspondence of results from different methods (Greene *et al.*, 1989). Analysis of data from Phase I and II proceeded concurrently; however, as all analyses were primarily conducted by a sole researcher (myself), implicit "mixing" of results occurred throughout the analytic process. While quantitative and qualitative data were not explicitly mixed, the use of complementary methods of inquiry supported high-level triangulation of results to improve our overall interpretation of the implications of combining HIV and MNCH CHW tasks.

Ethical Approvals

The study was jointly approved for ethical clearance by the Institutional Review Boards of JHSPH in Baltimore, Maryland (IRB No. 00005497) and MUHAS in Dar es Salaam, Tanzania (Ref. No. 2015-12-18/AEC/Vol. X/94). All potential study participants underwent a verbal informed consent process in Swahili using an IRB-approved consent form, with documentation of consent by the research staff.

Organization of Dissertation

The remainder of this document contains four chapters, three of which correspond to individual manuscripts:

- Chapter 2. Can volunteer CHWs manage multiple roles? An interrupted time series analysis of combined HIV and maternal, newborn and child health care in Iringa, Tanzania.

- Chapter 3. Leveraging CHWs for multiple roles in Iringa, Tanzania: An interrupted time series analysis of facility delivery utilization following integration of maternal, newborn, and child health care with existing HIV responsibilities of CHWs.

- Chapter 4. Because even the person living with HIV/AIDS might need to make babies" – Perspectives on drivers of feasibility, acceptance, and adoption within an integrated CHW program in Iringa, Tanzania.

A concluding chapter (Chapter 5) summarizes key findings across the three manuscripts, including strengths, limitations, and future research. The overall policy implications and relevancy of this research to ongoing community health implementation in Tanzania is discussed. A consolidated list of references follows the end of Chapter 5. Several appendices are included, documenting consent forms, in-depth interview guides, CHW demographic survey tool, and supplementary statistical annexes for Manuscripts 1 and 2.

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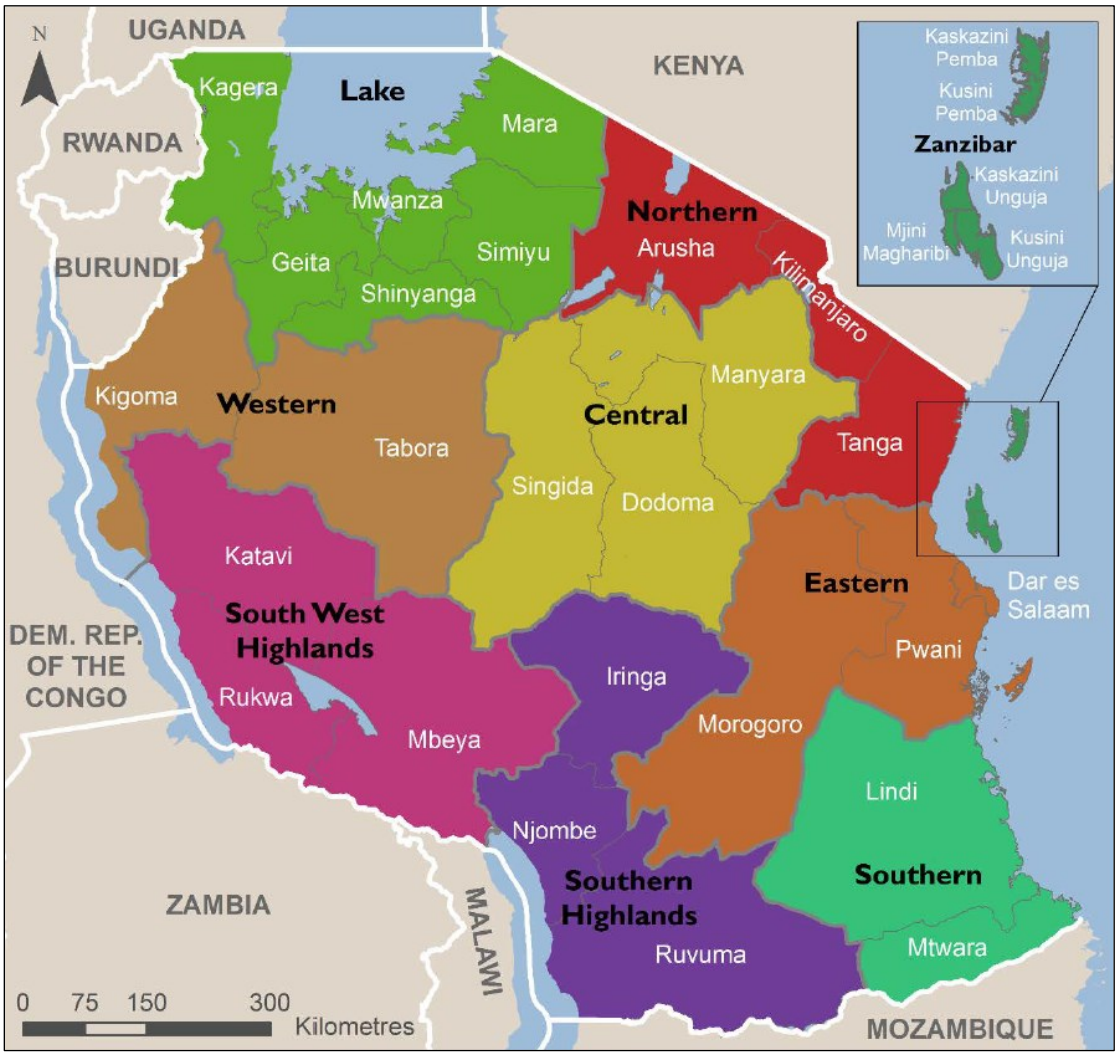
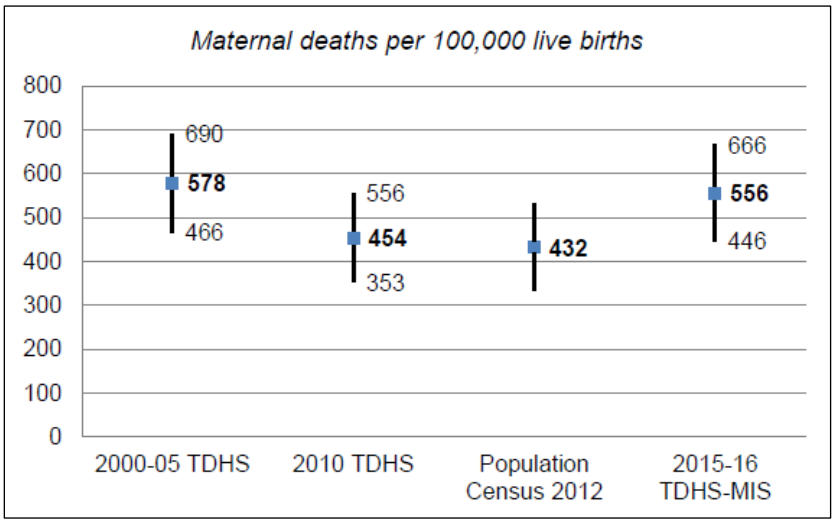
Figures and Tables

Figure 1. Map of Tanzania: 9 zones and 30 administrative regions.



Reproduced from Tanzania MoHCDGEC *et al.*, 2016b

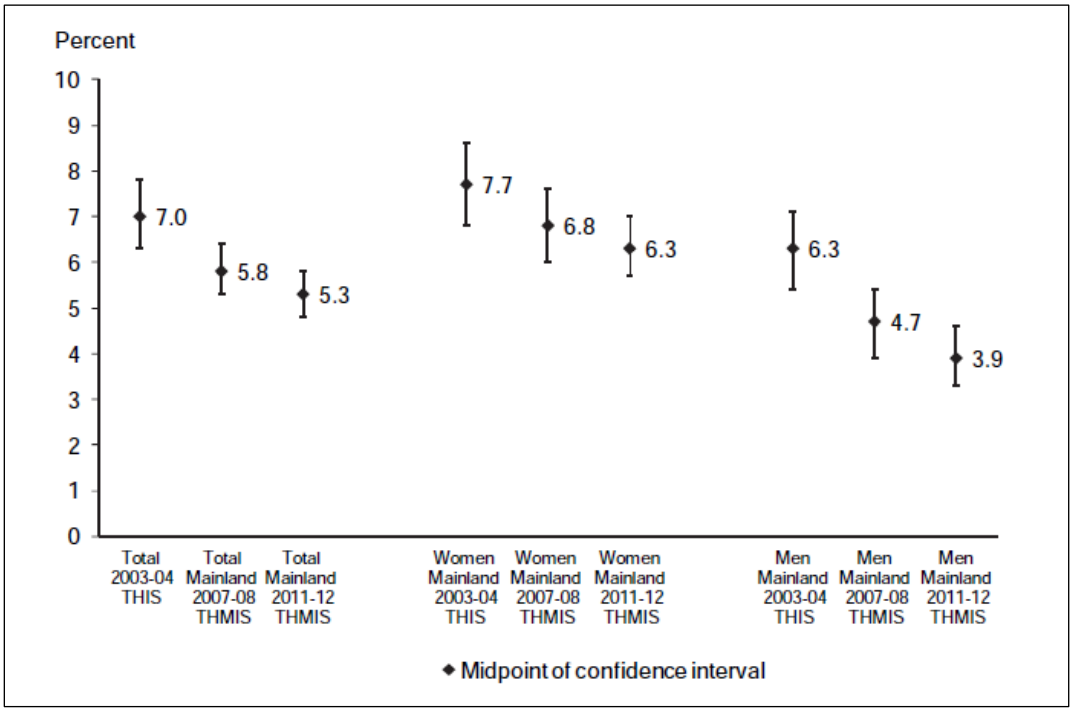
Figure 2. Trends in Tanzania's maternal mortality ratio, with confidence intervals.



Reproduced from Tanzania MoHCDGEC *et al.*, 2016b

Note: The DHS measures the maternal mortality ratio for the 10-year period prior to the survey. The 2012 Population Census estimated maternal deaths in the 1-year period prior to the census.

Figure 3. Trends in adult (age 15-49) HIV prevalence by sex, Mainland Tanzania, 2003-12.



Reproduced from Tanzania Commission for AIDS *et al.*, 2013

Figure 4. Administrative and service structure of the health system in Mainland Tanzania.

Reproduced from Kwesigabo *et al.*, 2012

Figure 5. Conceptual framework guiding the research.

Relationship between inputs, CHW role expansion, HIV and MNCH workload balance and prioritization of tasks, facility-based MNCH service utilization, and implementation outcomes.

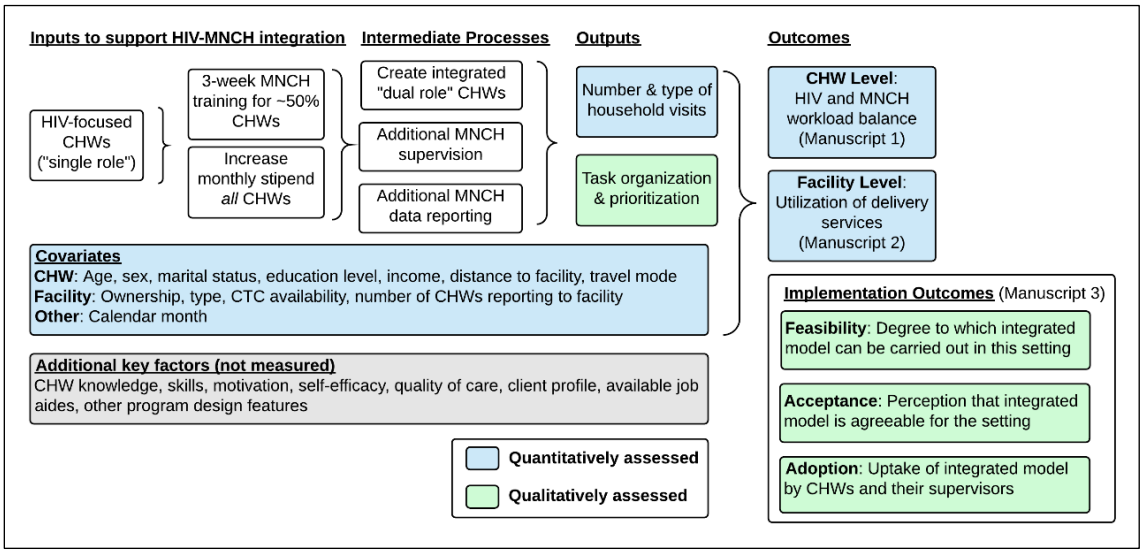
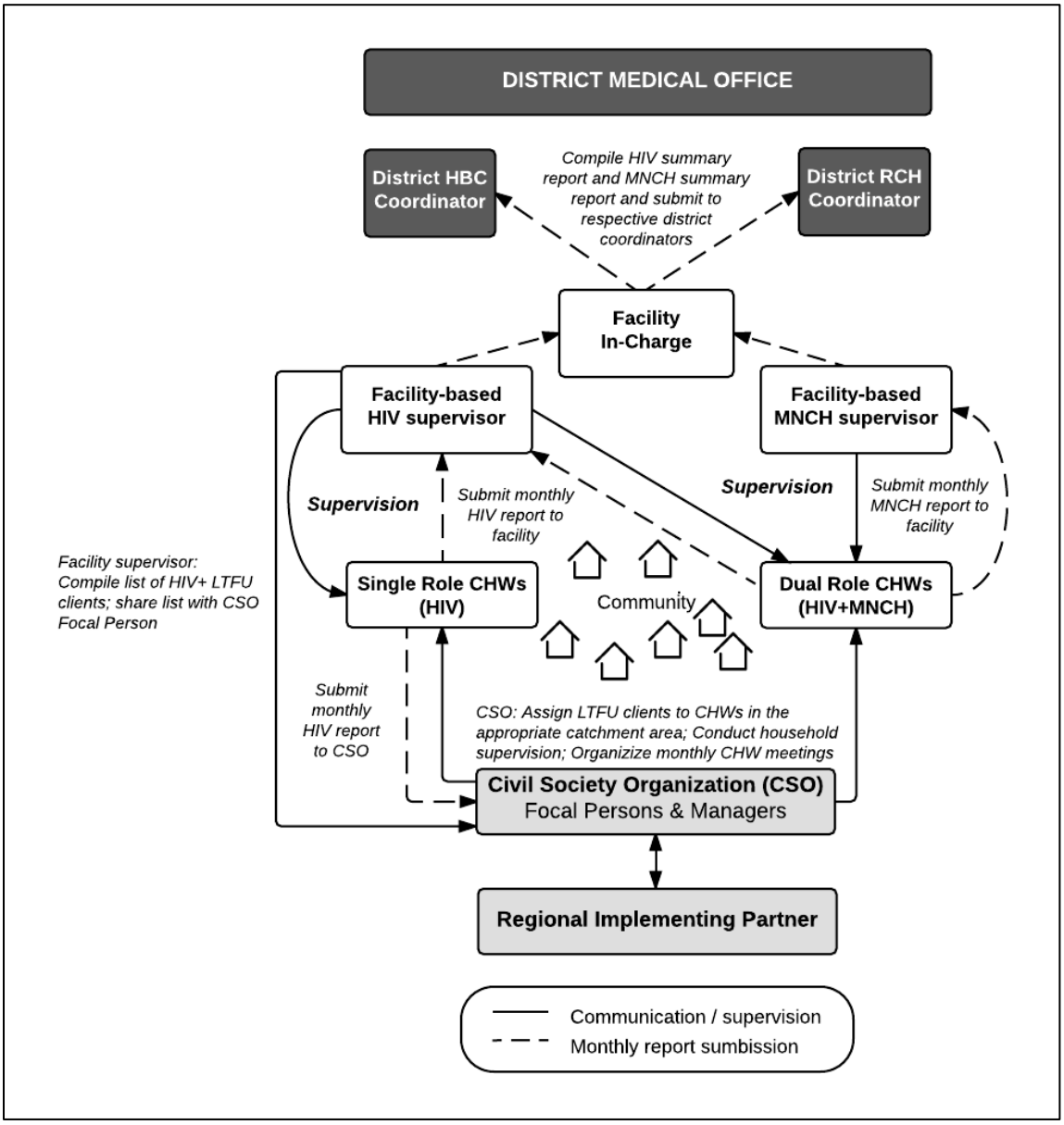


Figure 6. TUNAJALI program schematic.

Relationship between the regional implementing partner, civil society organization, CHWs, and health facility staff for data reporting flow and supervision.



CSO, civil society organization; HBC, home-based care; LTFU, lost to follow-up; RCH, reproductive and child health

Figure 7. Equal weighting QUAL-QUAN design.

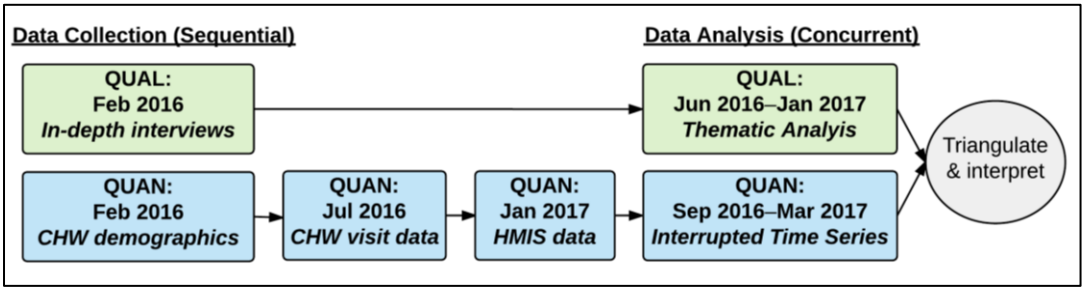


Table 1. Trends in maternal and child health indicators in Iringa and nationally, 2010-15.

Demographic and Health Survey (DHS) Indicator	2010 DHS (%)		2015-16 DHS (%)	
	Iringa	National	Iringa	National
Maternal Health†				
Women ≥ 1 live birth in last 5 years, for most recent birth:				
Received ANC care from skilled provider	97.3	95.9	99.4	98.0
Took iron tablets or syrup during pregnancy	65.1	58.9	82.6	81.1
Delivered in a health facility	80.2	50.2	92.8	62.6
Received PNC within two days of delivery	58.9	30.8	72.0	34.2
Total fertility rate, for 3 years preceding survey‡	5.4	5.4	4.3	5.2
Married women, current use any traditional contraception	9.9	7.0	14.5	6.4
Married women, current use any modern contraception	35.2	27.4	32.1	32.0
Child Health and Nutrition				
Children 12-23 months, received all basic vaccinations*	93.3	75.2	84.0	75.3
Children U5, diarrhea symptoms in 2 wk preceding survey	15.3	14.5	8.0	11.8
Children U5, ≥ 2 standard deviations below height-for-age	74.2	58.5	41.6	34.4
Children 6 months to 5 years, prevalence of anemia	45.6	58.6	40.3	57.7

†Measured for women of reproductive age, 15-49 years
‡Measured for Southern Highlands Zone, within which Iringa Region is located
*BCG, measles, three doses each of DPT and polio vaccine (excluding polio dose at birth)
ANC, antenatal care; PNC, postnatal care; U5, under five; ARI, acute respiratory infection; wk, week

Source: (Tanzania NBS and ICF Macro, 2011; Tanzania MoHCDGEC *et al.*, 2016b).

Table 2. Minimum package of services for home-based care CHW volunteers.

Minimum Package of HBC Services: Counseling topics and tasks
• HIV prevention education, safer sex promotion, community mobilization • Voluntary HIV counseling and testing and condom distribution • Stigma reduction advocacy • Palliative care for pain control, comfort, and end of life care • Health promotion for good hygiene and nutrition • Referral linkage to facility for opportunistic infections • Transferring skills to home care givers (family members) in basic nursing care, hygiene, positive living, nutrition, emotional support, infection prevention, and referral • Provision of social support information and referral to support groups, welfare services, care for orphans and vulnerable children, and material assistance • Advocacy to increase community resources through work with community leaders, faith based organizations, youth groups, and schools • Referral for social and economic services. • Counseling for spiritual and emotional support for stress and anxiety reduction

Source: (Tanzania Commission for AIDS)

Table 3. MNCH counseling topics and timing of antenatal and postnatal home visits by CHWs.

	Pregnancy Period			Postpartum Period							Quarterly
Counseling topic **Home Visit Timing:**	<24 wks	24 wks	32 wks	<24 hrs	72 hrs	7 days	3 wks	5 wks	12-16 wks	20-24 wks	to age 5
ANC booking											
Pregnancy danger signs											
Nutrition during pregnancy											
Maternal nutrition											
Birth preparedness											
Breastfeeding											
Lactational amenorrhea method											
Malaria prevention											
Immunization											
HIV/AIDS general information											
PMTCT											
HIV-exposed infant follow up											
Gender issues											
Postpartum danger signs											
Immediate newborn care											
Postpartum family planning											
Newborn danger signs											
Infection prevention and control											
Postpartum physiological changes											
Postpartum care for mother											
Care of premature & full term newborn											
Birth registration											
Child danger signs											
Complimentary feeding											
Prevention of accidents											
Growth and development											

Source: (Tanzania MoHSW, 2012)

Table 4. District council characteristics and number and type of health facilities.

District Councils	Kilolo	Iringa Rural
Population	218,130	254,032
Population annual growth rate, 2002-12 (%)	0.7	0.4
Rural-based population (%)	94.6	93.2
No. Households	50,728	60,484
No. Villages	106	123
No. Wards	22	25
Ward classification	Rural	Rural
No. Health Facilities	**54**	**75**
With single and/or dual role CHWs	32 (59%)	43 (57%)
No. Dispensaries, total	**51**	**64**
Government	35 (69%)	53 (83%)
Faith-based organization	11 (21%)	11 (17%)
Private	5 (10%)	0 (0%)
No. Health Centers, total	**2**	**10**
Government	1 (50%)	7 (70%)
Faith-based organization	1 (50%)	3 (30%)
No. Hospitals, total	**1**	**1**
Faith-based organization	1 (100%)	1 (100%)

Source: (Tanzania MoHSW, 2015b)

Chapter 2 Can volunteer community health workers manage multiple roles? An interrupted time series analysis of combined HIV and maternal and child health care in Iringa, Tanzania.

Abstract

Background

Community health workers (CHWs) can serve an important primary health care role by supporting health promotion at the individual and community level and by linking health facilities and communities. CHW programs are often oriented around a single disease, such as HIV, but there is renewed interest in expansion of multipurpose CHWs who cover an integrated package of services, particularly in resource-constrained countries faced with a chronic shortage in the health workforce. However, the number and type of tasks a CHW can effectively perform before quality and productivity decline from work overload and complexity is debated and requires further research. In this study, an existing cadre of HIV-focused volunteer CHWs was trained on maternal, newborn, and child health (MNCH) promotion in two districts of Iringa Region, Tanzania and assessed to understand whether the addition of MNCH tasks affected provision of HIV services.

Methods

The number of HIV client visits conducted per month was extracted from CHW monthly summary forms covering up to 14 months pre-intervention and 12 months of intervention data. A comparative interrupted time series design using a generalized estimating equation was used to assess population-averaged longitudinal trends in the intervention ("dual role" HIV/MNCH-focused CHWs) versus comparison group ("single role" HIV-focused CHWs). Analyses were stratified by district and took into account secular trends, seasonality, and CHW and facility covariates. The null hypothesis that addition of MNCH tasks resulted in no significant change in the mean monthly HIV visit count was tested.

Results

The sample included 187 CHWs (41% dual role; 59% single role), with no significant demographic

differences between groups. The time series consisted of 4,022 observations for HIV household visit count over the period May 2014 through June 2016, with an average of 21.5 data points per CHW. Prior to the MNCH intervention, dual role CHWs averaged 25 to 30% more HIV visits per month compared to single role CHWs (Iringa Rural: aIRR=1.25, p=.03; Kilolo: aIRR=1.30, p=.09), but there were no significant pre-intervention differences in slopes between groups. Results confirmed that CHWs began conducting MNCH-related household visits shortly after receiving training. However, in the immediate month of the MNCH intervention, an initial 6 to 9% drop in the mean number of HIV household visits per month among dual role CHWs was evident, relative to expected levels in the absence of the MNCH intervention (Iringa Rural: aIRR=0.94, p=.10; Kilolo: aIRR=0.91, p=.04). There was no significant difference between single and dual role CHWs in the trajectories of monthly HIV household visits before and after adding MNCH duties.

Conclusion

Dual role CHWs appeared able to maintain their HIV client workload while adding MNCH tasks to their routines, albeit with an initial slight interruption to their HIV workload. This partially-integrated health care model, which combined community level health promotion services for HIV patients, pregnant women, newborns, and children, suggests that there is spare capacity in vertically-oriented single disease focused programs and that gains can be made through integration. However, the quality of the visits by dual role CHWs and the long-term implications still needs to be evaluated.

Keywords: Community Health Worker, HIV, Integration, Interrupted Time Series, Maternal Child Health Services, Segmented Regression, Tanzania.

Introduction

The Declaration of Alma Ata in 1978 formalized primary health care as policy of member countries of the World Health Organization (WHO) (WHO and UNICEF, 1978). It also signaled international recognition of an important role for CHWs to support primary health care systems in achieving the goal of Health for All (Perry *et al.*, 2014). An ongoing global shortage of health care workers underscores the necessity of CHWs to extend primary health care services to under-served populations (WHO, 2006; WHO and GHWA, 2013). There is growing evidence that CHW programs can improve child nutrition, reduce maternal and neonatal mortality, increase child immunization uptake, expand family planning access, and contribute to control of HIV, tuberculosis, and malaria (Lewin *et al.*, 2010; Perry *et al.*, 2014). Furthermore, recent systematic reviews have shown the cost-effectiveness of task shifting to CHWs in low and middle income country settings, particularly for tuberculosis and HIV/AIDS care, in addition to suggestive cost savings for malaria, maternal and newborn health, and childhood illness programs, although the evidence is weaker (Vaughan *et al.*, 2015; Seidman and Atun, 2017). A compelling case has been made to strengthen CHW programs across Africa, which could result in an estimated 10:1 economic return on investment (MDG Health Envoy, 2015).

Consistent with the emerging global consensus around strengthening community-based primary health care, many countries have begun revitalizing, formalizing, and expanding national CHW programs (Liu *et al.*, 2011; WHO and GHWA, 2013). There is widespread variation in CHW programs in terms of task profiles, responsibilities, training, professional work status, remuneration, and integration of CHWs into the formal health care system. However, a defining characteristic of most CHWs is their provision of services within homes, villages, and community gatherings (Perry and Crigler, 2014), making them well-positioned to alleviate the geographic, financial, and cultural barriers to health care access of underserved populations (Lehmann and Sanders, 2007). While the focus of this study is on CHW service provision, CHWs also serve in health promotion, community participation and empowerment roles, thus making several key contributions to the primary health care system.

A central design question of policy interest is whether CHWs should provide services in one health care area ("vertical" / "specialist" approach) or integrated services across multiple health care areas ("horizontal" / "generalist" approach)? Integrated services are generally favored due to many potential benefits, including reduced fragmentation of services, improved care outcomes, and increased patient satisfaction (Shigayeva *et al.*, 2010). The recent movement toward people-centered health systems also supports integration through consideration of people's needs in the design and delivery of health care services (Sheikh *et al.*, 2014). Despite these advantages, however, at the community level there is continued debate over the number of tasks a CHW can effectively perform before quality and productivity begin to decline from work overload and task complexity.

In a systematic review of design factors that influence CHW performance, studies which examined CHW tasks and time spent on delivering services found that greater perceived responsibilities, longer service delivery times, and more weekly time spent on the job were associated with higher CHW performance, with responsibility for curative tasks bringing self-reported motivation and increased community recognition (Kok *et al.*, 2015). In Bangladesh, after treatment for severe acute malnutrition was added to the workload of CHWs focused on community case management of acute respiratory infection and diarrhea, they maintained quality of care for both preventive and curative tasks despite reporting significantly more hours worked per week (Puett *et al.*, 2012). In contrast, in Malawi, a qualitative study that explored task prioritization when CHWs had an integrated scope of responsibilities, identified several challenges: role confusion; overloading with too many tasks, with CHWs unable to fulfill multiple roles; specialization of tasks when CHWs received additional training on a specific skill, resulting in over-emphasis on the new skill; and difficulty managing competing priorities, due to multiple programs and stakeholder demands (Smith *et al.*, 2014). Recent literature has proposed a *community health system* as "the set of local actors, relationships, and processes engaged in producing, advocating for, and supporting health in communities and households outside of, but existing in relationship to, formal health structures" (Schneider and Lehmann, 2016). This definition moves beyond the narrow focus on CHWs: By characterizing community health work as a *sub-system* within primary health care, there is recognition

that a broad array of health system and community factors contribute to community health performance (Schneider and Lehmann, 2016).

In Tanzania, the existing network of CHWs is a partial stopgap for the health workforce shortage. A recent mapping analysis documented roughly 41,000 CHWs across Tanzania, mainly in volunteer-based and vertically-oriented single disease programs, with nearly half centered on either HIV *or* maternal, newborn, and child health (MNCH) (MUHAS and JHSPH, 2015). Integration of health care services, as defined by Tanzania's Community Based Health Program guidelines, includes: "combining health care services and components of health care services that are currently delivered and/or managed separately, for the purpose of optimizing the use of scarce resources, maximizing coverage of services, and improving health outcomes" (Tanzania MoHSW, 2014). Community-level service integration gained prominence in Tanzania with the training launch for the first cohort of multipurpose, paid CHWs that will provide both preventive and curative services and be embedded in the national health system (Buguzi, 2015).

Yet to be ascertained is the quantitative impact of additional work on CHW responsibilities regarding continued performance of their initial tasks. In this study, a cadre of volunteer HIV-focused CHWs in Tanzania was trained on MNCH promotion, integrating two distinct scopes of work at the community level. A comparative interrupted time series design was utilized to assess whether inclusion of MNCH tasks affected CHW's continued provision of HIV services. The null hypothesis was that the addition of MNCH tasks would result in no significant change in the level or trend of monthly HIV-related household visits conducted by CHWs.

Methods

Program Context

This study in Tanzania centers on a volunteer CHW program in the rural Southern Highlands of Iringa Region, 500 kilometers (KM) southwest of the largest city and commercial hub, Dar es Salaam. Compared to national trends, Iringa has consistently achieved higher rates of coverage for key MNCH indicators. The proportion of live births delivered at health facilities has improved over time in Iringa Region from 71.8%, 80.4%, to 92.9% as measured in the 2004-5, 2010, and 2015-16

Tanzania Demographic and Health Surveys, respectively. By comparison, national estimates in Tanzania have also risen over the same period, increasing from 47.1%, 50.1%, 62.6%, but remain far lower than the facility delivery coverage achieved in Iringa Region (Tanzania NBS and ORC Macro, 2005; Tanzania NBS and ICF Macro, 2011; Tanzania MoHCDGEC *et al.*, 2016). The prevalence of HIV in Iringa (9.1%) is the second highest in the country and nearly double the national average (5.1%), with an elevated prevalence among women (10.9%) compared to men (6.9%) (Tanzania Commission for AIDS *et al.*, 2013).

Across Iringa, an implementing partner (Deloitte) contracts with local civil society organizations to support and manage over 400 volunteer CHWs to provide home-based HIV services. Existing CHWs previously had been trained for 12 days to provide a variety of HIV support services, including tracking HIV patients who missed appointments, linking patients to HIV care, providing psychosocial support and palliative care, promoting antiretroviral treatment adherence, mobilizing the community, offering home-based HIV counseling and testing, and organizing economic strengthening groups. Most villages are supported by 1 or 2 HIV-focused CHWs, each covering approximately 15 to 100 households.

In 2014, the implementing partner received additional funding to begin supporting MNCH services, with a goal of increased utilization of antenatal care and facility deliveries. They recommended that HIV-focused CHWs could absorb additional MNCH responsibilities, rather than appointing and funding a separate cadre of MNCH volunteers. Their recommendation was based on observation that increased HIV treatment coverage and compliance has reduced HIV workload of CHWs due to a reduction in the number of extremely sick HIV patients in need of palliative services; and on the perceived benefits of integrating HIV and MNCH services by CHWs. Therefore, in 2015 approximately half of the CHWs were trained using a MNCH curriculum approved by Tanzania's Ministry of Health. This integrated cadre of "dual role" CHWs was to provide both HIV and MNCH services (compared to "single role" CHWs focused on HIV-only). With the reduced number of very sick HIV/AIDS patients, due largely to increased availability of antiretroviral therapy, program administrators perceived that HIV-focused CHWs could be leveraged to also provide additional

MNCH education in the community.

Selection for MNCH training was determined centrally by the implementing partner, without explicit criteria or input from local civil society organizations. MNCH training was conducted separately for the two districts during June 2015 (Kilolo) and November 2015 (Iringa Rural). The training included two weeks of classroom instruction and one week of practical sessions, covering a broad range of MNCH topics. Dual role CHWs were trained to visit a woman at least three times during pregnancy and seven times postpartum, with three home visits within the first week following birth. Follow-up visits were to be scheduled at three and five weeks, three and five months, and then quarterly until the child turns five. Health promotion topics depend on timing, but covered a range of issues, including: antenatal care booking; pregnancy danger signs; nutrition; birth preparedness; breastfeeding; newborn care; malaria prevention; HIV/AIDS; family planning; postpartum care; newborn and child danger signs; and growth and development.

Both single and dual role CHWs were provided with monthly HIV-focused supervision from a facility-based health care worker and a "focal person" based at the civil society organization. Dual role CHWs also received MNCH-focused supervision from an additional facility-based health care worker. CHWs were given a nominal monthly stipend for their volunteer service; following MNCH training the implementing partner increased the monthly stipend from $15 to $20 USD for all CHWs, irrespective of single or dual responsibilities.

Sampling

Among the four districts in Iringa Region where the program was implemented, two were excluded: Mufindi was excluded due to a separate ongoing initiative, the Partnership for HIV-Free Survival, which may have shifted increased attention toward prevention of mother-to-child HIV transmission; and Iringa Municipal was excluded due to its urban setting, less informative for the national development of a rural-based CHW cadre. All CHWs supported by the civil society organizations in the remaining two rural district (Iringa Rural and Kilolo) were eligible for inclusion in the study (n=212). Several CHWs were excluded due to death (n=4), resignation (n=2), and termination (n=13), or because the MNCH workload data could not be accessed (n=6) (Figure 1). The

final sample comprised 187 CHWs.

Measures

Data extracted from CHW monthly summary reports were used to quantify outcome measures. The "Number of HIV client visits conducted" is an aggregate measure of self-reported HIV visit workload per individual CHW per month. The "Number of maternal client visits conducted during the antenatal or postnatal period" and the "Number of children under-5 visits conducted" are additional aggregate measures to quantify MNCH visit workload per individual CHW per month (for dual role CHWs only).

CHW demographics and health facility characteristics were assessed, including: age, sex, education level (primary or secondary), marital status (married, single, widowed, divorced), number of dependents, years of CHW experience, monthly household income (<$25, $25-50, >$50 USD), income generating activities (agriculture, livestock, miscellaneous), supervisory facility type (dispensary, health center, hospital), supervisory facility ownership (government, faith-based), and distance to supervisory facility (KM) (Appendix 3).

A time series is composed of indicator values measured at regularly spaced time intervals, while a segment within a time series is a sequence of measures divided into two or more portions at defined change points (Wagner *et al.*, 2002). Using the aggregate summary measure of HIV client visits conducted per month, a time series dataset was created with a change point demarcating the 14-month baseline "pre-intervention" period from the "intervention" period when additional MNCH training, supervision, and reporting was introduced. The intervention period contained up to 7 (Kilolo) or 12 (Iringa Rural) monthly data points depending on when MNCH training occured. For dual role CHWs, MNCH visit data was extracted for the same 7 to 12-month intervention period.

Data Collection Procedures

Data were collected during two phases of field work occurring in February and July 2016, after the intervention was underway. During February 2016, a team of six trained research assistants administered the demographic questionnaire in Swahili to CHWs at regularly scheduled monthly

meetings organized by the civil society organizations. Absent CHWs were subsequently contacted to schedule alternate questionnaire arrangements, conducted in-person at a central location; however, some CHWs could not be surveyed due to travel, illness, or inability to contact the CHW. A total of 183 surveys were administered during February 2016, a 95% response rate from an expected 193 CHWs (excluding CHWs that died, resigned, or were terminated). Upon return to Iringa in July 2016, the research team contacted remaining CHWs, which resulted in 8 additional demographic surveys, for a total of 191 surveys (99% response). Data entry clerks performed double data entry of questionnaire responses into a Microsoft Access database.

In the second phase during July 2016, the HIV and MNCH outcome measures were collected from the respective CHW monthly summary forms and entered into a tablet-based electronic form by the research team (Appendix 4). For HIV, monthly summary forms compiled by CHWs were reviewed for the period May 2014 to June 2016, using paper copies stored in binders at the civil society organizations. The summary form contained a line-listing of all clients visited during the month for HIV services, from which an aggregate count of monthly HIV client visits for each CHW was extracted. For MNCH, dual role CHWs compiled a separate monthly summary form aggregating the total number of maternal and child household visits and submitted it to their facility-based MNCH supervisor. The research team again attended monthly meetings arranged by the civil society organizations to extract aggregate measures of MNCH visits directly from the dual role CHW's MNCH summary register book, since paper copies of the report were not submitted to the civil society organizations. Absent dual role CHWs were contacted to schedule in person meetings at a central location for MNCH data extraction.

Statistical Analysis

Summary descriptive statistics and exploratory data analysis using connected line plots and mean response profiles were examined to identify underlying trends in outcomes before and after introduction of MNCH responsibilities, examining intervention (dual role) versus comparison groups (single role). The average number of monthly HIV client visits per CHW during the pre-intervention period was assessed for baseline comparability between single and dual role CHWs. Pearson's chi-

square tests for categorical variables and two-sample t tests for continuous variables (with variance ratio tests) were performed to examine differences in demographic and facility characteristics between the districts and between single and dual role CHW groups. Missingness in the time series data was compared across groups, but reasons for missed monthly reports were not documented and could have been due to a variety of reasons, i.e. services were performed and the report was either misplaced or never submitted -or- no services were performed due to CHW illness, travel, or leave etc. Imputation methods were therefore not utilized and missing values were treated as "true" missing.

Longitudinal Analysis: Comparative Interrupted Time Series

Longitudinal trends before and after MNCH training were assessed using a comparative interrupted time series analysis, a quasi-experimental approach to establish causal inference (Taljaard *et al.*, 2014). The goal of the analysis was to assess the effect of the MNCH intervention package on the mean HIV client visit count in the immediate period after intervention initiation (level change) and gradually throughout the intervention (slope change), under the assumption that the intervention group outcome trend would have changed similarly to the comparison group without the intervention (Lagarde, 2012). It was assumed an immediate effect would be displayed in the next month following MNCH training.

Standard ordinary least squares regression estimation is inappropriate for time series data, since the assumption of independence of residuals is typically violated by autocorrelation (Biglan *et al.*, 2000). Least squares estimation is also inappropriate when the time series response variable is a count, since counts are nonnegative integer values, but a linear model offers the potential for negative mean response estimates (Chatterjee and Simonoff, 2013). Therefore, a log-linear Poisson regression using a generalized estimating equation (GEE) approach was used to account for potential data correlation in repeated measures from the same CHW, with an exchangeable correlation structure (assuming that any pair of responses from an individual CHW would have the same correlation) and robust estimation of standard errors (Liang and Zeger, 1986). The GEE approach was used to estimate the population-averaged response across CHWs in the intervention versus comparison groups. Segmented regression techniques (which estimate a different intercept and slope coefficient for the

pre-intervention and intervention time periods) were applied to control for secular trends (Wagner *et al.*, 2002; Lagarde, 2012; Penfold and Zhang, 2013).

Several implementation differences were notable across districts, including the different civil society organizations responsible for program management, timing of training introduction, and proportion of CHWs receiving the additional MNCH training. In addition, differences in pre-training outcome trends and several predictor variables were found through exploratory data analysis. Therefore, analyses were stratified to allow for differential effects by district.

Model specification.

Data was in the form Y_{ij} for the HIV client visit count obtained in the jth month (j=1,…,26) for CHW i (i=1,…,187). The population averaged expected response as a function of the covariates, $\mu_{ij} = E(Y_{ij}|X_{ij})$, was estimated with a log link function for count data under the assumption of a Poisson probability distribution as shown in Equation 1:

$$\log(\mu_{ij}) = \beta_0 + \beta_1 Time_{ij} + \beta_2 Post_{ij} + \beta_3\ Time_{ij}*Post_{ij} + \beta_4 MNCH_i + \beta_5 Time_{ij}*MNCH_i + \beta_6\ MNCH_i*Post_{ij} + \beta_7 Time_{ij}*MNCH_i*Post_{ij} + \beta_8 Rain_{ij} + \beta_{9\text{-}17} Z_i + \varepsilon_{ij}$$

where μ_{ij} is the average monthly count of HIV client visits per CHW given a pattern of predictor variables. $Time_{ij}$ represents the number of months before and after MNCH training was introduced in each district. $Time_{ij}$ is centered at 0 during the month training occurred, and ranges from -13 months pre-intervention up to +12 months during intervention. $Post_{ij}$ is an indicator variable representing pre-intervention and intervention periods for an individual CHW i. $MNCH_i$ is an indicator variable denoting an individual CHW's assignment to the intervention (dual role) or comparison group (single role). The model includes four interaction terms: $Time_{ij}*Post_{ij}$ accounts for any difference in the intervention and pre-intervention trend in the comparison group; $Time_{ij}*MNCH_i$ allows for different time trends for the single and dual role CHWs; $MNCH_i*Post_{ij}$ indicates differential changes in the number of HIV visits conducted by single versus dual role CHWs immediately following initiation of the intervention; and the three-way interaction term $Time_{ij}*MNCH_i*Post_i$ accounts for a possible difference in the rate of change in the number of HIV visits conducted by single and dual role CHWs between pre-intervention and intervention periods. The adjusted model contained an indicator

variable, $Rain_{ij}$, to account for Iringa's rainy season (December through April). Time invariant explanatory covariates with the potential to influence the outcome, including a CHW's sex, years of experience, income category, and travel time to facility, along with facility type and ownership, are represented by Z_i. The random error is denoted by ε_{ij}.

Unadjusted and adjusted regression results are reported as incidence rate ratios (IRR) with 95% confidence intervals. Non-significant *p*-values for the β_4 and β_5 coefficients indicate the single and dual role CHW groups are balanced at baseline in terms of the level and slope of the outcome variable, respectively. A significant *p*-value in either β_6 or β_7 coefficients denotes a treatment effect following introduction of MNCH training (immediately β_6 level, or gradually over time β_7 slope). Model diagnostics included examination of residual versus fitted plots and quasi-likelihood information criterion (QIC) to identify the best working correlation structure (exchangeable vs. independent) and most parsimonious model (Appendix 5) (Cui, 2007). All statistical analyses were run in Stata Version 13 (StataCorp, 2013).

Ethical Considerations

Ethical clearance for this study was jointly approved by the Institutional Review Boards of Johns Hopkins School of Public Health (IRB No. 00005497) and Muhimbili University of Health and Allied Sciences (Ref. No. 2015-12-18/AEC/Vol. X/94). All potential study participants underwent a verbal informed consent process in Swahili using an IRB-approved consent form for the demographic questionnaire, with documentation of verbal consent by research staff. In additional, permission was sought by the regional and district medical administrative authorities.

Results

Sample Characteristics

The sample included 187 CHWs, of which 41% (*n*=76) were dual role CHWs and 59% (*n*=111) were single role CHWs (Table 1). Overall, CHWs had a mean age of 43.2 years (*SD*=7.4) with 8.8 years (*SD*=3.6) of community health experience, and 5.5 dependents (*SD*=2.3). Just over half of CHWs were female (53%), and nearly all were married (85%) and primary school educated (92%).

Roughly 40% of CHWs reported a monthly income less than $25 USD; most (95%) reported agricultural farming as a source of additional income, while far fewer (19%) reported livestock farming, and 27% reported other income generating activities. The median distance between a CHW's home and supervisory facility was 4 KM (*IQR* 1-8), and most CHWs (63%) reported walking as their primary mode of travel to household visits. A majority of CHWs (56%) reported travel times to the supervisory facility of less than one hour. CHWs were linked to dispensary facilities (76%), health centers (15%), or hospitals (9%) for supervision and reporting purposes, the majority of which were operated by the government (67%).

Bivariate Analyses

Comparing single and dual role CHWs.

Bivariate analyses of single and dual role CHWs noted no significant differences across groups regarding demographic characteristics (Table 1). However, dual role CHWs were less likely to report to a dispensary-level health facility (59 vs. 88%; $p<.001$).

Comparing districts.

CHWs by district were similar in terms of age, sex, marital status, education, monthly income, agriculture and livestock farming, and transportation to household visits and supervisory facilities. However, there were several statistically significant differences between districts (Table 2). Iringa Rural CHWs had more dependents (5.9 vs. 5.1 dependents, $p=.02$), fewer years of community health experience (8.3 vs. 9.2 years, $p=.04$), shorter distance and travel times to supervisory facilities (3.9 vs. 10.9 KM, $p<.001$; 42 vs. 18% travel time < 30 minutes, $p<.001$), and a higher proportion engaged in miscellaneous income generating activities compared to Kilolo CHWs (41 vs. 16%, $p<.001$). In terms of supervisory facility characteristics, a lower proportion of Iringa Rural CHWs reported to facilities run by faith-based organizations (21 vs. 43%, $p=.001$), a higher proportion reported to health centers (19 vs. 11%, $p=.05$), and a lower proportion reported to the district hospital compared to Kilolo CHWs (4 vs. 13%, $p=.05$).

Comparing single and dual role CHWs, stratified by district.

Bivariate analyses suggested sufficient comparability between single and dual role CHWs by

district, with no significant demographic differences (Table 2). However, in both districts the average reported distance from a CHW's village to their supervisory facility was slightly farther (borderline statistically significant) for single versus dual role CHWs (Iringa Rural: 4.5 vs. 2.6 KM, p=.07; Kilolo: 13.2 vs. 8.8 KM, p=.09). There was no association between facility ownership and single versus dual role CHWs in either district. In Kilolo, single role CHWs were more likely to report to dispensaries versus dual role CHWs (94% vs. 57%, p<.001). This difference was less pronounced in Iringa Rural (83 vs. 64%, p=0.15), but remained statistically significant in the full sample (88 vs. 59%, p<.001).

Characteristics of Time Series

The time series consisted of 4,022 observations for HIV visit count from May 2014 through June 2016, averaging 21.5 data points per CHW (Table 3). There were 2,352 observations (58%) in the pre-intervention period and 1,670 observations (42%) in the intervention period, averaging 12.6 and 8.9 months of data, respectively. Patterns of missingness in the HIV count variable were assessed: of an expected 4,447 monthly observations from 187 CHWs, 425 observations (9.6%) were missing. Missingness occurred more frequently during pre-intervention (10.2%; n=266) than intervention (8.7%; n=159), and was relatively more frequent in Kilolo (10.8%; n=292) than Iringa Rural (7.6%; n=133). However, within each district, there was no difference in the average months of data available from single versus dual role CHWs during the pre-intervention nor intervention periods, suggesting similar reporting completeness across groups (Table 3). Following MNCH training, 620 MNCH observations on maternal and under-5 child household visits were available from 76 dual role CHWs, or an average of 8.2 months of data per CHW for the full sample (7.1 months in Iringa Rural; 8.9 months in Kilolo). Reporting completeness for MNCH data was lower than HIV data, with 21.2% of the 787 expected observations missing.

Effect of MNCH Training on HIV Visit Count

During pre-intervention, single role CHWs conducted an average of 27 HIV visits per month, while dual role CHWs conducted an average of 39. Productively remained stable and during intervention single role CHWs conducted an average of 28 HIV visits per month with dual role CHWs again reporting a monthly average of 39 HIV visits (Table 4). Greater overall means were observed for both single and dual role CHWs in Kilolo compared to Iringa Rural (Table 4

Table). In addition to monthly HIV visits, during the intervention, dual role CHWs in Iringa Rural conducted an average of 9 maternal visits and 42 under-5 child visits per month, while in Kilolo they conducted an average of 7 maternal visits and 46 under-5 child visits per month (Table 4).

A time series plot of the mean HIV, maternal, and child under-5 visit count per month for single and dual role CHW is shown for each district, with trends from the predicted fit for mean HIV count from the segmented regression model (Figure 2). Regression results of the estimated effect of MNCH role expansion on the mean count of HIV visits conducted by CHWs is presented for each district (Table 5), as described below for the adjusted models.

Iringa Rural

In Iringa Rural, the time series plot suggests a gradually increasing trend for both single and dual role CHWs, which continues without noticeable interruption into the intervention period (Figure 2). The pre-intervention trend among single role CHWs was significant, with each additional month associated with a 1% increase in mean HIV visit count (aIRR=1.01, 95% CI: 1.00–1.01, *p*=.004). There was also a significant pre-intervention difference in outcome level between groups (β_4), with a 25% higher mean HIV visit count among dual role CHWs compared to single role CHWs within a given month, holding all other variables constant (aIRR=1.25, 95% CI: 1.02–1.52, *p*=.03). However, there was no difference in the pre-intervention slopes (β_5) between single and dual role CHWs in Iringa Rural, suggesting that the single and dual role groups had similar outcome trajectories prior to introduction of MNCH responsibilities.

Kilolo

In Kilolo, the time series plot indicates greater variability in the data and different pre-intervention secular trends in HIV visit count, with a possible change in outcome trajectories during the intervention period (Figure 2). For single role CHWs the regression output confirms the pre-intervention and intervention slopes were significantly different (β_3), holding all other variables constant (aIRR=0.99, 95% CI: 0.98–0.99, p=0.005). As reflected in the time series plot, during pre-intervention, dual role CHWs had a 42% higher average HIV visit count when compared to single role CHWs prior to adding MNCH responsibilities (IRR=1.42, 95% CI: 1.10–1.83, p=.007); this difference between groups was smaller and borderline significant after adjusting for covariates (aIRR=1.30, 95% CI: 0.95–1.76, p=.096). Although the pre-intervention productively levels were different among dual and single role CHWs in Kilolo, there was no difference in pre-intervention slopes (β_5), again suggesting sufficient comparability in outcome trajectories between single and dual role CHW groups prior to introduction of MNCH responsibilities.

Summary of Intervention Effects (β6 and β7)

The interrupted time series results from both districts suggest a modest treatment effect in the change in level (β_6) in the immediate post-period after intervention introduction. This is indicated by a

moderately significant intervention minus pre-intervention change in mean HIV visit count among dual role CHWs relative to the change among single role CHWs, after holding all other variables constant (Table 5: Iringa Rural: aIRR=0.94, 95% CI: 0.87–1.01, p=.096; Kilolo: aIRR=0.91, 95% CI: 0.83–0.99, p=.04). The magnitude of the effect was similar across districts, suggesting an initial 6 to 9% drop in continued provision of HIV services following introduction of a second role (MNCH), relative to the expected level in the absence of the MNCH intervention. However, there was no difference in either district in the change in trend (β_7) in the mean HIV client visit count conducted by single and dual role CHWs over time. These results suggest a small initial drop in HIV services provided by CHWs following the introduction of a second role (MNCH). Equilibrium appeared to have been quickly achieved following role expansion, as evidenced by the lack of significant change in slopes following the intervention.

Discussion

This study sought to examine the impact of role expansion on the 10-year-old program of HIV-focused volunteer CHWs in Iringa, Tanzania. Could CHWs maintain their HIV scope of work after introduction of a second MNCH role? Our regression results indicate they can, but not without a small initial interruption to services when the intervention initially rolled out. Immediately after MNCH responsibilities were introduced, there was a slight dip in HIV household visits conducted by dual role CHWs relative to single role CHWs. While the overall level recovered over time in Iringa Rural, it remained lower in Kilolo where a slightly lower equilibrium was reached during intervention. However, there was no statistically significant difference in the dual role intervention and pre-intervention trend in monthly HIV visits compared to the expected change in trend in the absence of the intervention. Dual role CHWs appeared able to maintain their HIV client load while adding MNCH tasks to their volunteer routines. The number of HIV clients visited per month remained stable, while the overall number of clients served increased as dual role CHWs began offering MNCH household visits to pregnant and post-partum women, plus children under 5 years old identified through a village census.

Volunteer CHWs may spend only a few days a week on CHW-related tasks. A survey in Morogoro, Tanzania documented work patterns of MNCH CHWs averaging 2.9 work days per week and 4.8 hours per day (LeFevre *et al.*, 2015). In an integrated model with CHWs responsible for more activities, more time and effort by volunteers is needed to improve services, and role overload becomes a key risk (Schneider *et al.*, 2016). Realistic expectations of workloads are needed to prevent CHW burnout and sustain motivation, particularly within volunteer programs. In Ethiopia, the integration of family planning with HIV services by volunteer community-based reproductive health agents did not increase the overall number of clients reached, since the time spent with each client lengthened. Also, the reproductive health agents had other daily tasks which limited their hours for volunteer activities (Creanga *et al.*, 2007). Our study was unable to document the number of hours spent on volunteer CHW activities before and after MNCH training, but future work should assess additional workload metrics.

A profile of the CHWs in our study showed similar demographic characteristics between single and dual role groups, although CHWs that reported to higher-level facilities were more likely to receive MNCH training. However, we did not analyze individual CHW characteristics as potential drivers of performance of HIV and MNCH tasks, and this could be an important area of future research. For example, in Zimbabwe, individual and organizational factors associated with CHW performance varied by task within the context of a "multi-task" program where CHWs were responsible for both pregnancy referrals and delivery of behavior change lessons, which suggests pathways to improve CHW performance could also vary by task and are important to explore within settings where CHW roles are expanding (Kambarami *et al.*, 2016).

CHW productivity is postulated to be influenced by three interrelated factors: capacity, motivation, and work environment (Jaskiewicz and Tulenko, 2012). While capacity and motivation have been extensively studied, an enabling, facilitative work environment to maximize productivity has not been widely researched. To explore how CHWs balanced both the HIV and MNCH scopes of work, qualitative in-depth interviews were conducted with CHWs, their supervisors, and program management staff. Most dual role CHWs re-organized their schedules to accommodate new MNCH

activities. However, they largely did not offer "one-stop shopping", visiting HIV and MNCH clients on separate days (for further discussion, see Manuscript 3). The systems of CHW data reporting, supervision, and program management also remained siloed within HIV and MNCH domains. Therefore, the program was actually "partially integrated" – dual role CHWs provided HIV and MNCH services on different days, although on some occasions reported providing both services to the same client during a single household visit. From the national level to the facility level, HIV and MNCH are separate units within the health sector and therefore not surprising that full integration by CHWs was not achieved.

Few studies have examined HIV and MNCH integration at the community level. Only one such program in Ethiopia was identified in a recent systematic review of 20 studies of integration of HIV, MNCH, family planning, and nutrition services (Creanga *et al.*, 2007; Lindegren *et al.*, 2012). In Tanzania, where roughly half of volunteer CHW programs are either HIV or MNCH-focused, the results of our study are highly relevant to ongoing implementation decisions, supporting further integration of HIV and MNCH services at the community level.

Strengths and Limitations

A major strength of this study was use of quasi-experimental causal inference methods to assess the impact of adding MNCH tasks onto monthly HIV visits before and after MNCH intervention, relative to the single role CHW comparison group. This study quantitatively assesses the impact of CHW role expansion on pre-existing roles and contributes to an important gap in the literature on HIV/MNCH care integration at the community level. Findings may be particularly relevant to other HIV home-based care volunteer CHW programs in Tanzania, documented at over 7,000 CHWs (MUHAS and JHSPH, 2015).

Findings should be considered in light of several study limitations. Randomization of the MNCH intervention would have improved the study design and reduced the potential for selection bias, but the strong comparability between single and dual role CHWs on measured covariates helped to increase internal validity. However, dual role CHWs had a higher level of pre-intervention productivity compared to single role CHWs, making it impossible to rule out selection bias. CHWs

reporting to health centers and hospitals were more likely to receive the additional MNCH training, suggesting a possible preference by the implementing partner to select CHWs affiliated with higher volume facilities.

The sample size was relatively small (<200), despite inclusion of all available volunteer CHWs supporting the program in two districts. In addition, the duration of observation was limited, particularly in Iringa Rural with only 6 months of intervention data – a longer period of observation would have improved confidence in the longer-term trends. A further limitation was the lack of assessment of the quality of services provided by CHWs, along with verification of their self-reported data through confirmation with clients that the household visits in fact occurred. The outcome measurement focused only on whether CHWs performed HIV and MNCH household visits. While missing data approached nearly 10%, it likely did not affect our overall inferences since patterns of missingness were similar across groups. Furthermore, the counts for HIV and MNCH services were extracted in aggregate from separate CHW monthly summary forms for HIV and MNCH, precluding an assessment of service integration within individual households. Data were also not independently verified between summary forms and source documents, although, the civil society organizations and implementing partner conducted routine data quality audits.

Conclusion

The dual role CHW model appears feasible in Tanzania, where volunteer HIV CHWs successfully added MNCH services to their household visits, although with a small initial reduction in HIV household visits when the intervention was first introduced. There was no difference between single and dual role CHWs in trajectories of monthly HIV household visits before and after MNCH duties were added. This partially-integrated health care model, which combined community level health promotion services for HIV patients, pregnant women, newborns, and children, suggests that there is spare capacity in vertically-oriented single disease focused programs and that gains can be made through integration. However, the quality of the visits by dual role CHWs and the long-term implications still needs to be evaluated.

Chapter 2 References

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Figures and Tables

Figure 1. Schematic of the CHW study sample from two rural districts of Iringa Region.

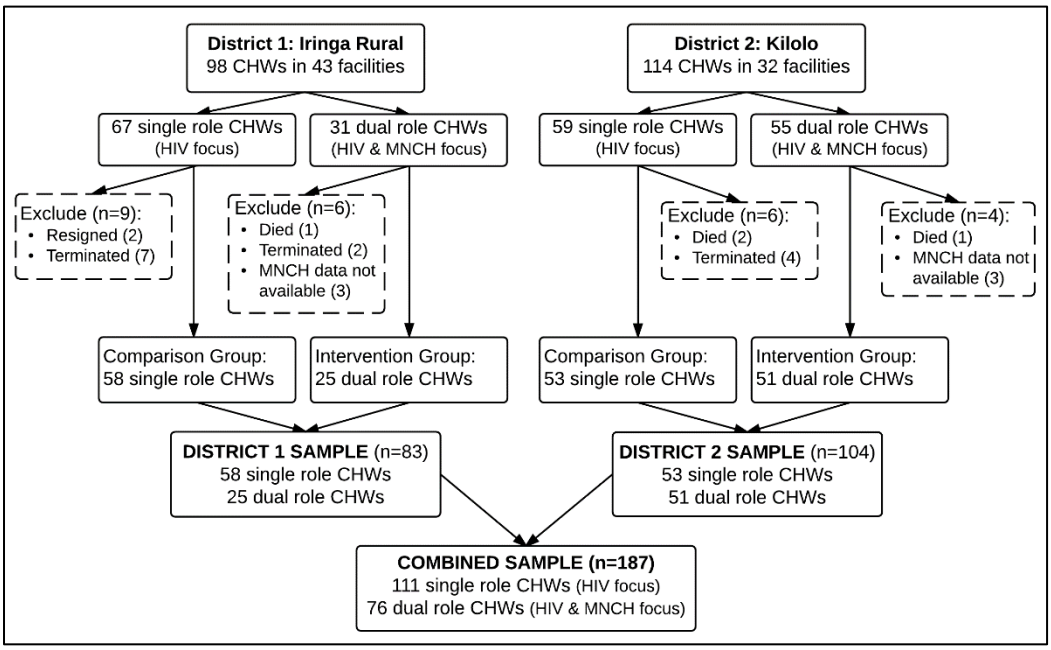

Figure 2. Time series plot of mean monthly HIV and MNCH visits conducted per CHW, by district.

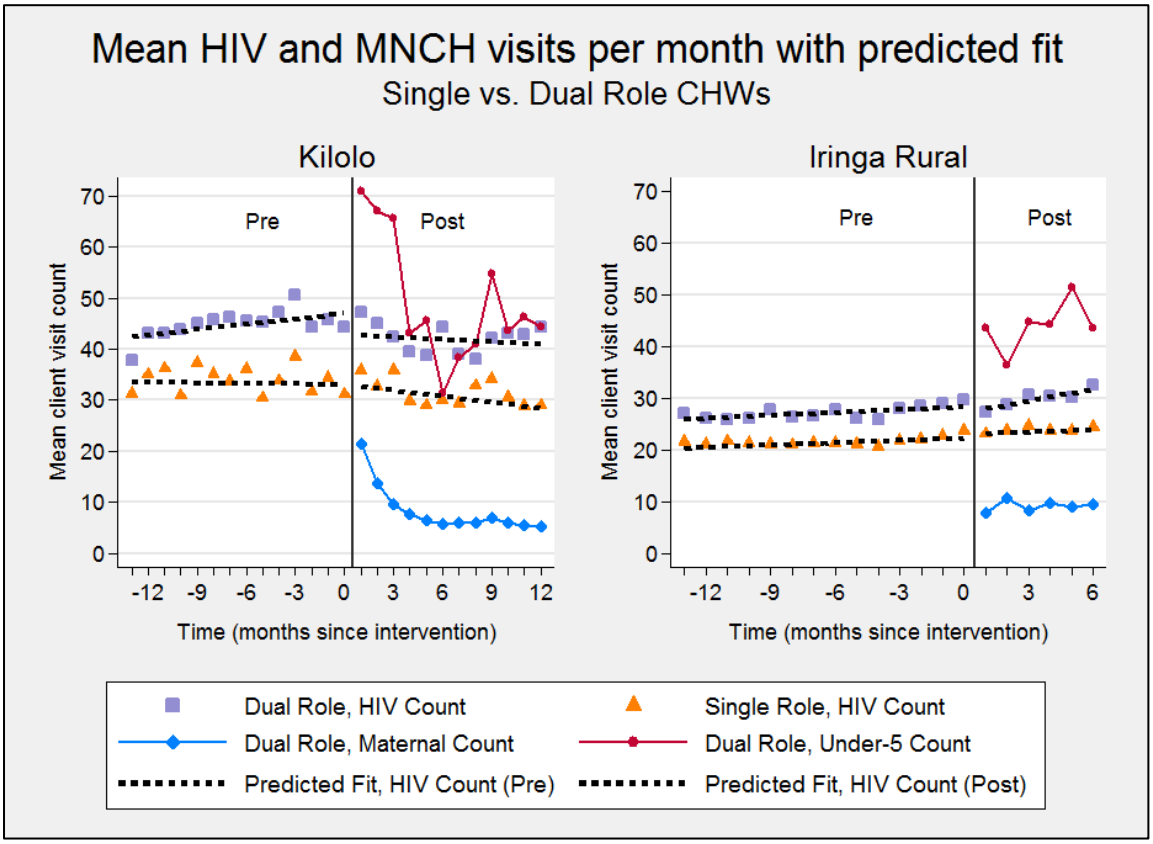

Table 1. Demographic and facility characteristics, comparing single and dual role CHWs.

	All CHWs	Single Role	Dual Role	
	n=187; 100%	n=111; 59.4%	n=76; 40.6%	
Demographic Characteristics	**Mean ± SD; or n (%)**			***p***
Age (Years)	43.2 ± 7.4	43.4 ± 7.5	43.0 ± 7.3	0.72
Dependents (Number)	5.5 ± 2.3	5.5 ± 2.3	5.4 ± 2.6	0.81
CHW experience (Years)	8.8 ± 3.6	8.9 ± 3.4	8.8 ± 3.9	0.95
Sex (Female)	100 (53.5)	62 (55.9)	38 (50.0)	0.43
Education level				
Primary school (Standard 7) or less	171 (91.9)	103 (93.6)	68 (89.5)	0.31
Secondary school (Form 4)	15 (8.1)	7 (6.4)	8 (10.5)	
Marital status				
Married	159 (85.5)	91 (82.7)	68 (89.5)	0.21
Single	10 (5.4)	5 (4.6)	5 (6.6)	
Widowed	13 (7.0)	11 (10.0)	2 (2.6)	
Divorced	4 (2.1)	3 (2.7)	1 (1.3)	
Monthly income (USD)				
Less than $25	76 (41.3)	46 (42.2)	30 (40.0)	0.70
Between $25-50	60 (32.6)	37 (33.9)	23 (30.7)	
More than $50	48 (26.1)	26 (23.9)	22 (29.3)	
Income earning activities				
Agriculture farming (binary)	177 (95.2)	102 (92.7)	75 (98.7)	0.06
Livestock farming (binary)	35 (18.8)	17 (15.5)	18 (23.7)	0.16
Other miscellaneous† (binary)	51 (27.4)	33 (30.0)	18 (23.7)	0.34
Travel mode to household visits				
Walk	117 (62.9)	69 (62.7)	48 (63.1)	0.81
Bicycle	54 (29.0)	31 (28.2)	23 (30.3)	
Motorcycle	15 (8.1)	10 (9.1)	5 (6.6)	
Supervisory facility travel time				
< 30 minutes	53 (28.6)	31 (28.4)	22 (28.9)	0.58
30-59 minutes	51 (27.6)	33 (30.3)	18 (23.7)	
≥ 60 minutes	81 (43.8)	45 (41.3)	36 (47.4)	
Supervisory facility distance (KM)	7.8 ± 11.0	8.5 ± 10.5	6.8 ± 11.6	0.33
Facility Characteristics		**n (%)**		***p***
Supervisory facility type* **				
Dispensary	143 (76.5)	98 (88.3)	45 (59.2)	<0.001
Health Center	28 (15.0)	9 (8.1)	19 (25.0)	
District Hospital	16 (8.5)	4 (3.6)	12 (15.8)	
Supervisory facility ownership				
Government	125 (66.8)	80 (72.1)	45 (59.2)	0.07
Faith-Based	62 (33.2)	31 (27.9)	31 (40.8)	

Significant at: *p <0.05; **p <0.01; ***p <0.001

†Includes bartender, carpenter, cleaner, counselor, fisherman, grocer, miner, preacher, shop owner, small business, tailor, trader, or timber seller

Table 2. Demographic and health facility characteristics by district and comparing single and dual role CHWs within each district.

	District 1	District 2		District 1: Iringa Rural			District 2: Kilolo		
				Single Role	Dual Role		Single Role	Dual Role	
	n=83; 44%	n=104; 56%		n=58; 70%	n=25; 30%		n=53; 51%	n=51; 49%	
Demographic Characteristics	**Mean ± SD; or n (%)**		***p***	**Mean ± SD; or n (%)**		***p***	**Mean ± SD; or n (%)**		***p***
Age (Years)	43.9 ± 7.2	42.6 ± 7.6	0.23	44.3 ± 7.0	43.1 ± 7.6	0.49	42.3 ± 8.0	42.9 ± 7.2	0.70
Dependents (Number)*	5.9 ± 2.3	5.1 ± 2.3	0.02	6.0 ± 2.4	5.6 ± 2.1	0.43	4.9 ± 2.0	5.3 ± 2.5	0.34
CHW experience (Years)*	8.2 ± 3.1	9.3 ± 3.9	0.04	8.4 ± 3.3	8.0 ± 2.8	0.60	9.4 ± 3.5	9.2 ± 4.3	0.83
Sex (Female)	46 (55.4)	54 (51.9)	0.63	32 (55.2)	14 (56.0)	0.95	30 (56.6)	24 (47.1)	0.33
Education level									
Primary school (Standard 7) or less	77 (92.8)	94 (91.3)	0.71	54 (93.1)	23 (92.0)	0.86	49 (94.2)	45 (88.2)	0.28
Secondary school (Form 4)	6 (7.2)	9 (8.7)		4 (6.9)	2 (8.0)		3 (5.8)	6 (11.8)	
Marital status									
Married	67 (80.7)	92 (89.3)	0.32	47 (81.0)	20 (80.0)	0.35	44 (84.6)	48 (94.1)	0.37
Single	5 (6.0)	5 (4.9)		2 (3.4)	3 (12.0)		3 (5.8)	2 (3.9)	
Widowed	8 (9.7)	5 (4.9)		7 (12.1)	1 (4.0)		4 (7.7)	1 (2.0)	
Divorced	3 (3.6)	1 (0.9)		2 (3.5)	1 (4.0)		1 (1.9)	0 (0.0)	
Monthly income (USD)									
Less than $25	31 (38.3)	45 (43.7)	0.10	22 (38.6)	9 (37.5)	0.77	24 (46.2)	21 (41.2)	0.51
Between $25-50	33 (40.7)	27 (26.2)		22 (38.6)	11 (45.8)		15 (28.8)	12 (23.5)	
More than $50	17 (21.0)	31 (30.1)		13 (22.8)	4 (16.7)		13 (25.0)	18 (35.3)	
Income earning activities (binary)									
Agriculture farming	78 (94.0)	99 (96.1)	0.50	53 (91.4)	25 (100.0)	0.13	49 (94.2)	50 (98.0)	0.32
Livestock farming	12 (14.5)	23 (22.3)	0.17	7 (12.1)	5 (20.0)	0.35	10 (19.2)	13 (25.5)	0.45
Other miscellaneous†***	34 (41.0)	17 (16.5)	<0.001	24 (41.4)	10 (40.0)	0.91	9 (17.3)	8 (15.7)	0.83
Travel mode to household visits									
Walk	56 (67.5)	61 (59.2)	0.41	38 (65.5)	18 (72.0)	0.83	31 (59.6)	30 (58.8)	0.73
Bicycle	20 (24.1)	34 (33.0)		15 (25.9)	5 (20.0)		16 (30.8)	18 (35.3)	
Motorcycle	7 (8.4)	8 (7.8)		5 (8.6)	2 (8.0)		5 (9.6)	3 (5.9)	

Supervisory facility travel time* **									
< 30 minutes	35 (42.2)	18 (17.7)	<0.001	22 (38.0)	13 (52.0)	0.44	9 (17.7)	9 (17.7)	0.90
30-59 minutes	23 (27.1)	28 (27.4)		18 (31.0)	5 (20.0)		15 (29.4)	13 (25.5)	
≥ 60 minutes	25 (30.1)	56 (54.9)		18 (31.0)	7 (28.0)		27 (52.9)	29 (56.8)	
Supervisory facility distance (KM)* **	3.9 ± 5.3	10.9 ± 13.2	<0.001	4.5 ± 5.9	2.6 ± 3.2	0.07	13.2 ± 12.7	8.8 ± 13.4	0.09
Facility Characteristics	**n (%)**		***p***	**n (%)**		***p***	**n (%)**		***p***
Supervisory facility type*									
Dispensary	64 (77.1)	79 (76.0)	0.05	48 (82.8)	16 (64.0)	0.15	50 (94.3)	29 (56.8)	<0.001
Health Center	16 (19.3)	12 (11.5)		8 (13.8)	8 (32.0)		1 (1.9)	11 (21.6)	
District Hospital	3 (3.6)	13 (12.5)		2 (3.4)	1 (4.0)		2 (3.8)	11 (21.6)	
Supervisory facility ownership**									
Government	66 (79.5)	59 (56.7)	0.001	46 (79.3)	20 (80.0)	0.94	34 (64.1)	25 (49.0)	0.12
Faith-Based	17 (20.5)	45 (43.3)		12 (20.7)	5 (20.0)		19 (35.9)	26 (51.0)	

Significant at: *p <0.05; **p <0.01; ***p <0.001

†Includes bartender, carpenter, cleaner, counselor, fisherman, grocer, miner, preacher, shop owner, small business, tailor, trader, or timber seller

Table 3. Time series characteristics: total and average number of HIV visit count observations comparing pre-intervention and intervention periods among single and dual role CHWs, stratified by district.

	Pre-Intervention n (%); mean	Intervention n (%); mean	Total n (%); mean
Iringa Rural			
Single Role	734 (66.0); 12.6	378 (34.0); 6.5	1,112 (100); 19.2
Dual Role	327 (65.7); 13.1	171 (34.3); 6.8	498 (100); 19.9
Total	1,061 (65.9); 12.8	549 (34.1); 6.6	1,610 (100); 19.4
Kilolo			
Single Role	658 (53.8); 12.4	565 (46.2); 10.7	1,223 (100); 23.1
Dual Role	633 (53.2); 12.4	556 (46.8); 10.9	1,189 (100); 23.3
Total	1,291 (53.5); 12.4	1,121 (46.5); 10.8	2,412 (100); 23.2

Table 4. Mean number of visits by CHWs for the total sample and by district**,** comparing single and dual role CHWs in the pre-intervention and intervention periods.

	Pre-Intervention		**Intervention**	
	Single Role	**Dual Role***	**Single Role**	**Dual Role***
HIV visits	**Mean ±SD, range**	**Mean ±SD, range**	**Mean ±SD, range**	**Mean ±SD, range**
Iringa Rural	21.6 ±8.0, 4-48	27.2 ±10.3, 11-60	24.0 ±9.3, 6-49	30.2 ±13.2, 9-73
Kilolo	34.0 ±25.7, 4-204	45.0 ±31.0, 3-159	31.4 ±25.2, 4-195	42.2 ±29.8, 7-160
Total	27.4 ±19.6, 4-204	38.9 ±27.2, 3-159	28.4 ±20.7, 4-195	39.4 ±27.3, 7-160
Maternal visits†				
Iringa Rural				9.0 ±9.4, 0-80
Kilolo				6.9 ± 8.2, 0-70
Total				7.5 ±8.6, 0-80
Child U5 visits				
Iringa Rural				41.9 ±45.5, 0-211
Kilolo				45.6 ±72.6, 0-647
Total				42.2 ±52.2, 0-647

*Maternal and Under-5 visit data only available during the intervention period for dual role CHWs
†Maternal includes first and repeat antenatal and postnatal care household visits

Table 5. Regression results stratified by district: Impact of MNCH intervention on maintenance of monthly HIV visit count conducted by CHWs, May 2014-June 2016.

	District 1: Iringa Rural		District 2: Kilolo	
Model parameters	**IRR (95% CI)**	**aIRR (95% CI)**	**IRR (95% CI)**	**aIRR (95% CI)**
Intercept, single role (β_0)	22.32 (20.3–24.5) ***	15.14 (8.7 – 26.5) ***	32.97 (27.7–39.2) ***	62.6 (23.9–163.7) ***
Pre-period trend, single role (β_1)	1.01 (1.00–1.01) ***	1.01 (1.00–1.01) **	1.00 (0.99–1.01)	1.00 (0.99–1.01)
Diff. single role level, immediate post (β_2)	1.03 (0.98–1.07)	1.04 (0.99–1.10)	1.01 (0.94–1.07)	1.01 (0.94–1.08)
Diff. single role slope, post-pre (β_3)	1.00 (0.99–1.01)	1.00 (0.99–1.01)	0.99 (0.98–0.99) **	0.99 (0.99–0.99) **
Pre-period diff. dual vs. single role intercept (β_4)	1.26 (1.06–1.50) **	1.25 (1.02–1.52) *	1.42 (1.10–1.83) **	1.30 (0.95–1.76)
Pre-period diff. dual vs. single role slopes (β_5)	1.00 (0.99–1.01)	1.00 (0.99–1.01)	1.01 (0.99–1.02)	1.01 (1.00–1.02)
Diff. dual vs. single role levels, immediate post (β_6)	**0.95 (0.88–1.02)**	**0.94 (0.87–1.01)**	**0.91 (0.83–0.99) ***	**0.91 (0.83–0.99) ***
Diff. diff. dual vs. single role slopes, post-pre (β_7)	**1.02 (0.99–1.04)**	**1.02 (0.99–1.04)**	**1.00 (0.99–1.02)**	**1.00 (0.99–1.02)**
Rainy season (β_8)	--	0.99 (0.98–1.01)	--	1.01 (0.99–1.03)
Facility ownership (Ref: Government) (β_9)	--	1.05 (0.77–1.41)	--	0.99 (0.61–1.59)
Facility type: Health Center (Ref: Dispensary) (β_{10})	--	1.07 (0.84–1.37)	--	1.08 (0.50–2.35)
Facility type: Hospital (Ref: Dispensary) (β_{11})	--	1.00 (0.61–1.64)	--	1.28 (0.70–2.33)
Facility travel time: 30-59 min. (Ref: <30 min.) (β_{12})	--	0.92 (0.73–1.15)	--	1.03 (0.62–1.73)
Facility travel time: ≥60 min. (Ref: <30 min.) (β_{13})	--	0.79 (0.63–0.99) *	--	0.85 (0.53–1.36)
CHW's sex (Ref: Male) (β_{14})	--	1.29 (1.07–1.55) **	--	0.82 (0.60–1.12)
CHW's years of experience (β_{15})	--	0.99 (0.96–1.02)	--	0.98 (0.93–1.03)
CHW's income: $25-50/mo. (Ref: <$25/mo.) (β_{16})	--	1.10 (0.90–1.34)	--	0.85 (0.58–1.26)
CHW's income: >$50/mo. (Ref: <$25/mo.) (β_{17})	--	1.19 (0.95–1.50)	--	0.95 (0.63–1.42)
Estimated within CHW correlation† (R^2)	0.805	0.796	0.897	0.896

Significant at: *p <0.05; **p <0.01; ***p <0.001
aIRR, adjusted incidence rate ratio; CI, confidence interval
Bold indicated main treatment effect of the intervention
†Based on exchangeable correlation structure

Chapter 3 Leveraging community health workers for multiple roles in Iringa, Tanzania: An interrupted time series analysis of facility delivery utilization following integration of maternal, newborn, and child health with existing HIV responsibilities of CHWs

Abstract

Background

Community health workers (CHWs) can serve an important primary health care role through linking health facilities and communities. While CHW programs are often oriented around single services, interest has grown in developing multipurpose CHWs. In this study, an existing cadre of HIV-focused CHWs in Iringa, Tanzania was trained in maternal, newborn, and child health (MNCH) education and promotion. This analysis examines changes in facility delivery utilization following the addition of MNCH responsibilities to the existing CHW workload, within a predominantly rural context with already high facility delivery coverage (>90%).

Methods

The number of facility deliveries per month was extracted from facilities in two districts of Iringa Region using routine health management information system data. The final sample consisted of 68 facilities, including 2 hospitals, 10 health centers, and 56 dispensaries. Included in the time series dataset from January 2014–December 2016 were 2,448 observations for facility delivery count, 58% occurring pre-intervention. Interrupted time series analyses using a generalized estimating equation was used to evaluate population-averaged longitudinal trends in facility delivery at intervention and comparison facilities. Analyses were stratified by district and controlled for secular trends, seasonality, and facility covariates.

Results

During the MNCH intervention, there was no significant change from baseline in the average number of facility deliveries observed at intervention health centers/dispensaries, although a slight downward trend was observed. At the hospital-level, there was a significant 16% increase in monthly deliveries moving from an average of 202 to 234 deliveries in Iringa Rural and from 167 to 194 deliveries in

Kilolo during pre-intervention and intervention, respectively. Districts displayed different patterns of intervention effect: In Kilolo, hospital deliveries increased gradually, but significantly, during the intervention, whereas in Iringa Rural there was an initial significant jump in hospital deliveries that was sustained over time. While the overall number of facility deliveries remained fairly stable across each district, increasing about 1%, the relative change in proportion of deliveries at hospitals increased by 14.7% in Iringa Rural and 17.2% in Kilolo ($p<.001$). Total facility deliveries were relatively stable over time at the district level, increasing about 1%, yet the relative change in proportion of hospital deliveries out of total facility deliveries significantly increased by approximately 17% in Iringa Rural and 15% in Kilolo ($p<0.001$). Hence, community level efforts to counsel women on the importance of facility delivery may be an effective approach to increase hospital delivery.

Conclusion

In rural Tanzania, the increase in hospital deliveries suggests that community-level health promotion efforts to encourage facility delivery may be effective, particularly for reaching the last 10% of underserved pregnant women. In conjunction with the conclusions from Manuscript 1, that dual role CHWs were able to manage both HIV and MNCH responsibilities, this study offers evidence that community-delivered MNCH may have contributed to increased deliveries at the hospital-level. Further research is necessary to explore *how* HIV-MNCH integration may have helped increase facility delivery utilization.

Keywords Bypassing, Community Health Worker, Interrupted Time Series, Facility Delivery, Maternal Child Health Services, Segmented Regression, Tanzania.

Introduction

There were an estimated 8,200 maternal deaths in the United Republic of Tanzania in 2015 (WHO, 2015). Tanzania has made progress in reducing the maternal mortality ratio, with an average annual reduction of 3.7% since 1990, but this pace was insufficient to achieve the Millennium Development Goal #5 target for improved maternal health (WHO, 2015). According to Tanzania's latest Demographic and Health Survey (DHS) (2015-16), the estimated 556 maternal deaths per 100,000 live births signal that progress in reducing maternal deaths has stalled or possibly reversed. These estimates correspond to a 3% lifetime risk of maternal death in Tanzania, with 1 in 33 dying during pregnancy, childbirth, or within two months postpartum (Tanzania MoHCDGEC *et al.*, 2016). Hemorrhage, hypertension, sepsis, and unsafe abortion are the leading causes of maternal death in Tanzania (Afnan-Holmes *et al.*, 2015). Timely access to safe delivery services is important for maternal mortality reduction. Reducing maternal deaths remains a priority for Tanzania's Ministry of Health, setting targets for skilled birth attendance (80%) and facility deliveries (90%) by 2020 (Tanzania MoHCDGEC, 2016).

The multi-tiered, decentralized structure of Tanzania's formal health system is organized by districts, including dispensaries (6,000-10,000 catchment) for basic delivery services, health centers (50,000 catchment), and hospitals offering emergency obstetrical care through referral (Kwesigabo *et al.*, 2012; Armstrong *et al.*, 2016). Decades of investment in the rural health care system produced an extensive network of health facilities among the highest density in African countries (Ramsey *et al.*, 2013). The majority of Tanzanians live within 5 kilometers (KM) of a primary health care facility, but underutilization of services is common due to quality concerns (Kante *et al.*, 2016). Over the last two decades, urban–rural inequities in childbirth services have persisted across Tanzania, with women in rural areas half as likely to deliver in a health facility as women living in urban areas (Figure 1a) (Afnan-Holmes *et al.*, 2015).

The present study is based in Iringa Region in Tanzania's Southern Highlands, located 500 KM southwest of Dar es Salaam, the largest city and commercial hub of Tanzania. The HIV prevalence (9.1%) in Iringa Region disproportionately affects women (10.9%) compared to men

(6.9%), and is second highest in the country, nearly double the national average (5.1%) (Tanzania Commission for AIDS *et al.*, 2013). Although Iringa Region is predominantly rural, it is among the national leaders in coverage of key maternal, newborn, and child health (MNCH) services, with the proportion of live births delivered at health facilities in Iringa Region improving over time from 71.8% (2004-05) to 80.4% (2010) and 92.9% (2015-16), per the most recent Tanzania DHS data (Figure 1b). For the same years, facility deliveries nationally increased only from 47.1% to 50.1% and 62.6%, far lower than in Iringa Region (Figure 1b). In 2014, Iringa Region had the country's second highest density of skilled health workforce (8.3 per 10,000 population) and the highest facility density (3.1 facilities per 10,000 population), nearly double that of mainland Tanzania (Armstrong *et al.*, 2016). The density of facilities in Iringa is the most likely determinant of the high facility delivery coverage (Straneo *et al.*, 2016).

Strategies are still needed to reach the last 10% of women who remain underserved and deliver at home. Home visits conducted by community health workers (CHWs) is a complementary strategy to increase coverage of care and improve maternal and newborn survival (Tanzania MoHSW, 2012). Prior research in Tanzania has shown community driven approaches can be effective in mobilizing women to deliver at health facilities (Mushi *et al.*, 2010). In the previous chapter, it was shown that dual role CHWs were largely able to maintain their HIV visit workload when MNCH tasks were added to their responsibilities. The objective of this paper is to assess the impact of dual role CHWs on facility delivery utilization.

Methods

Program Context

Over the past decade, an implementing partner (Deloitte) has supported local civil society organizations in managing over 400 volunteer CHWs who provide home-based HIV services in Iringa Region. CHWs previously had received 12 days of training to provide a variety of supportive services: Tracking HIV patients who missed appointments; linking patients to HIV care; providing psychosocial support and palliative care; promoting antiretroviral treatment adherence; offering home-based HIV counseling and testing; and organizing economic strengthening groups. Villages are

supported by one or two HIV-focused volunteer CHWs, each following approximately 15-100 households with clients living with HIV. By living and working at the village level, these CHWs serve as a link between the health system and the community.

In 2014, the implementing partner received additional funding to begin supporting MNCH services, with a goal of increased utilization of antenatal care and facility deliveries. They recommended that HIV-focused CHWs could absorb additional MNCH responsibilities, rather than appointing and funding a separate cadre of MNCH volunteers. The basis for their recommendation was two-fold: observation that increased HIV treatment coverage and compliance has reduced HIV workload of CHWs due to a reduction in the number of extremely sick HIV patients in need of palliative services; and the perceived benefits of integrating HIV and MNCH services by CHWs.

During 2015, approximately half of CHWs received MNCH training from a government-approved curriculum, establishing a "dual role" CHW tasked with both HIV and MNCH services (compared to "single role" CHWs focused on HIV-only). The implementing partner selected the CHWs for MNCH training, without explicit criteria or input from the managing local civil society organizations. MNCH training consisted of two weeks of classroom and one week of practicum sessions, conducted separately for the two districts: in June 2015 for Kilolo and November 2015 for Iringa Rural. The MNCH curriculum covered a variety of health promotion topics, organized around the timing of home visits during the antenatal, postpartum, and early childhood periods. These included: antenatal care booking, pregnancy danger signs, nutrition, birth preparedness, breastfeeding, malaria prevention, HIV/AIDS, PMTCT, gender issues, family planning, newborn care, newborn danger signs, infection prevention, and postpartum care and changes in the mother. CHWs were instructed on recommended frequency and timing of MNCH visits, including at least three antenatal home visits, seven postpartum and infant health home visits, and quarterly child health home visits until five years of age. During antenatal home visits, CHWs provide specific counseling on:

- Early health care seeking behavior
- Maintaining a healthy and balanced diet
- Developing an individualized birth plan and complication preparedness
- Recognizing pregnancy danger signs (plus referral to facilities for management)
- Importance of male partner involvement in reproductive health

- Importance of knowledge and disclosure of HIV status
- Healthy timing and spacing for future pregnancies
- Health promotion and prevention of malaria, HIV/PMTCT, and tuberculosis (Tanzania MoHSW, 2012)

Separate HIV and MNCH-focused supervision support for CHWs was provided by facility-based health care workers, with additional monthly check-ins from "focal persons" based at the civil society organizations. A monthly stipend was provided to CHWs, which increased from $17 to $20 USD for all CHWs following MNCH training, regardless of single or dual responsibilities.

Sampling

The program was implemented in four districts of Iringa Region, but two were excluded from the study sample. Mufindi was excluded due to an ongoing initiative of the Partnership for HIV-Free Survival, which would likely shift the program toward prevention of mother-to-child HIV transmission. Iringa Municipal was excluded due to its urban location, considered less applicable to the national development of a rural-based CHW cadre. Among 143 facilities in the remaining two districts, Iringa Rural and Kilolo, 23 facilities were excluded due to lack of routine MNCH data reported into the government's electronic health management information system (HMIS). This left sampling from 120 facilities (Figure 2). All dispensaries, health centers, and hospitals supported by CHWs from the civil society organizations were eligible for inclusion (n=75; 63%). Facilities were grouped according to the type of CHW reporting there. Facilities with single role CHWs were designated the comparison group (n=32), with one facility excluded due to unavailable HMIS baseline data. Facilities with dual role CHWs were designated the intervention group (n=21). Among the remaining dispensaries and health centers supported by both single and dual role CHWs, only facilities with ≥ 50% dual role CHWs were included in the intervention group (n=15), while all others (n=6) were excluded due to a low dose of CHW MNCH training intervention. The hospital in each district was included, being supported by a mix of single and dual role CHWs and also serving as the referral point for all high-risk deliveries in the district. The final sample consisted of 32 comparison facilities and 36 intervention facilities (n=68) (Figure 2). The locations of sampled facilities are presented in Figure 3. The region's physical geography explains facility clustering toward the center:

the Udzungwa Mountains National Park covers the Eastern edge of Kilolo, while the Western half of Iringa Rural falls within Ruaha National Park.

Data Sources

A longitudinal dataset was compiled using several sources of information: (1) Monthly HMIS data; (2) CHW demographic survey data; and (3) Health facility characteristics data.

HMIS Data

Health facilities record data on key services using standard reporting registers and submit reports to the District Health Office monthly, whereupon a HMIS officer performs electronic data entry into a software platform called DHIS2 (Tanzania MoHSW, 2013). Aggregate monthly count data from January 2014 – December 2016 were used for the primary dependent longitudinal outcome variable of service utilization, which was the number of facility deliveries per month. Facility-level HMIS data on deliveries was provided electronically from the Ministry of Health.

CHW Demographic Survey Data

As previously described in Manuscript 1, a paper-based CHW demographic survey was administered in Swahili to 183 CHWs by a team of six trained research assistants during February 2016. An additional 8 surveys were administered in July 2016 to CHWs previously missed due to travel, illness, or contact failure (99% response rate from an expected 193 CHWs). In the survey, CHWs stated whether they received MNCH training (yes/no) and the name of the facility to which they report for supervision. CHW self-reported MNCH training status and facility location was cross-verified with the official records from the civil society organizations; any discrepancies were then discussed and rectified by the civil society organizations. This information was used to determine the total number of CHWs reporting to each facility and calculate the proportion of CHWs that received MNCH training ("MNCH training dose"). Facilities were then assigned to the comparison (MNCH training dose=0) or intervention group (MNCH training dose ≥0.50).

Health Facility Characteristics Data

Facility-level time invariant explanatory covariates were extracted from an online health facility registry tool maintained by the government (Tanzania MoHSW, 2015). Information on facility

type (hospital, health center, or dispensary), ownership (government or faith-based organization), availability of HIV care and treatment center (CTC) services, distance to neaest referral point, number of beds and number of delivery beds was downloaded from the registry in January 2017.

Longitudinal Dataset

A time series is composed of indicator values measured at regularly spaced intervals, while a segment within a time series is a sequence of measures divided into portions at defined change points (Wagner *et al.*, 2002). The monthly facility delivery counts, facility assignment in intervention or comparison group, and facility characteristics were merged into a time series dataset using facility and district names plus service month and year to identify each observation. A change point was created to demarcate the "pre-intervention" from the "intervention" period when additional MNCH training, supervision, and reporting was introduced. The pre-intervention contained up to 13 (Iringa Rural) or 18 (Kilolo) monthly data points depending on when the dual role CHW received MNCH training, while the intervention contained up to 23 (Iringa Rural) or 18 (Kilolo) monthly data points.

Statistical Analysis

Summary descriptive statistics and exploratory data analysis using connected line plots and mean response profiles by intervention and comparison facilities were examined to identify underlying trends in facility delivery volume before and after introduction of MNCH responsibilities for CHWs. The average volume of facility deliveries pre-intervention was assessed for baseline comparability between the intervention and comparison groups. Pearson's chi-square tests for categorical variables and two-sample t tests for continuous variables (with variance ratio tests) were performed to examine differences in facility characteristics between the districts and between intervention and comparison groups. T tests were also used to test for significant differences in the average facility deliveries per month during the pre-intervention and intervention periods – a pre/post comparison prior to specifying the longitudinal time series models. Hospitals were analyzed separately due to their high volume of deliveries and lack of hospitals in the comparison group.

Missing Data

Missingness in the HMIS facility delivery data was assessed from labor and delivery (L&D)

reports: of an expected 2,448 monthly observations, 80 values were missing (3.3%) from 35 facilities, with relatively more missing data in Iringa Rural (n=57, 4.3% from 24 facilities) than Kilolo (n=23, 2.2% from 11 facilities). The DHIS-2 system was rechecked for the 80 missing values to confirm report availability and the true missing values as follows: 19 L&D reports (24%) never submitted to DHIS-2; 23 L&D reports (29%) submitted to DHIS-2 but contained no data; 30 L&D reports (37%) contained number of expected pregnancies, with other data missing. In addition, 8 L&D reports (10%) contained some data elements, but the facility delivery value was missing, necessitating recoding (from missing to zero) based on discussion with Tanzania's National Bureau of Statistics.[2] To achieve stronger balance in the time series dataset, imputation methods were applied to the 72 observations (2.9%) with true missing data on facility delivery count: 45 missing values were imputed to the facility's average number of facility deliveries per month pre-intervention, while 27 missing values were imputed to the facility's average number of facility deliveries per month during intervention.

Longitudinal Analysis: Interrupted Time Series

Longitudinal trends in facility delivery before and after MNCH training were assessed using an interrupted time series (ITS) analysis, a quasi-experimental approach to establish causal inference when random assignment is not possible (Taljaard *et al.*, 2014). The underlying assumption is that outcome trends for the intervention group would change similarly to comparison group outcome trends in the absence of intervention (Lagarde, 2012). Ordinary least squares regression models are inappropriate for time series data, as the assumption of independence of residuals is often violated by autocorrelation in the outcome measure over time (Biglan *et al.*, 2000). Instead, segmented regression techniques (which estimate a different intercept and slope for pre-intervention and intervention periods) were applied to control for secular trends, as well as adjust for potential data correlation in the number of deliveries per facility over time (Wagner *et al.*, 2002; Lagarde, 2012; Penfold and Zhang, 2013). Use of least squares estimation is also inappropriate when the response variable is a count, since counts are nonnegative integer values, but a linear model offers the possibility for

[2] Zero values entered in submitted reports to DHIS2 are converted to missing values to save byte storage space in the database.

negative mean response estimates (Chatterjee and Simonoff, 2013). For that reason, a Poisson distribution was utilized.

The goal of this modeling approach was to assess how much the mean number of facility deliveries changed both immediately following intervention (level change) and gradually over the course of intervention (slope change). It was assumed an immediate effect would be displayed the next month after MNCH training for CHWs, with an expected gradual ramp up of increased facility deliveries as CHWs identified and referred more pregnant women in their communities.

A log-linear Poisson regression using a generalized estimating equation (GEE) approach with a first-order autoregressive working correlation structure was specified to account for correlation in repeated measures from the same facility (Liang and Zeger, 1986). Serial correlation in panel data was confirmed using the Woolridge test (Drukker, 2003). GEE analyses were stratified to allow for differential effects by district. In addition, separate models were assessed for hospitals (no comparison group, i.e. single group ITS analysis) and health centers / dispensaries (comparison group, i.e. "multiple group" ITS analysis). District stratification was supported through exploratory data analysis where differences in pre-intervention outcome trends in facility deliveries and several predictor variables were noted. In addition, there were several implementation differences by district, including different civil society organizations responsible for program management, timing of MNCH training, and overall proportion of CHWs receiving additional MNCH training.

Hospital-level Model Specification

Data was in the form Y_{ij} for the number of facility deliveries in the jth month (j=1,…,36) from facility i (i=1,…,68). The population-averaged expected response as a function of the covariates, $\mu_{ij} = E(Y_{ij}|X_{ij})$, was estimated with a log link function for count data under the assumption of a Poisson probability distribution for the hospital-level model in Equation 1:

$$\log(\mu_{ij}) = \beta_0 + \beta_1 Time_{ij} + \beta_2 Post_{ij} + \beta_3\ Time_{ij}*Post_{ij} + \beta_4 Month_{ij} + \varepsilon_{ij} \qquad \text{(Eq. 1)}$$

where μ_{ij} is the average monthly facility delivery count given a pattern of predictor variables. $Time_{ij}$ represents the number of months before and after MNCH training was introduced in each district.

$Time_{ij}$ is centered at 0 during the month training occurred, and ranges from -22 months pre-intervention up to +18 months during intervention. $Post_{ij}$ represents the pre-intervention and intervention time periods for a facility *i.* $Time_{ij}$*$Post_{ij}$ is an interaction term to account for any difference in intervention and pre-intervention trends. $Month_{ij}$ is an indicator variable for each calendar month time interval to control for seasonality and long term trends. ε_{ij} denotes random error. A scaling adjustment of standard errors was included in the GEE approach to correct for overdispersion (Bhaskaran et al. 2013).

Health Center / Dispensary-level Model Specification

The health center / dispensary-level model builds on Equation 1 by adding a comparison group as illustrated in Equation 2:

$$\log(\mu_{ij}) = \beta_0 + \beta_1 Time_{ij} + \beta_2 Post_{ij} + \beta_3\ Time_{ij}*Post_{ij} + \beta_4 MNCH_i + \beta_5 Time_{ij}*MNCH_i + \beta_6\ MNCH_i*Post_{ij} + \beta_7 Time_{ij}*MNCH_i*Post_{ij} + \beta_8 Month_{ij} + \beta_9 Type_i + \beta_{10} Owner_i + \beta_{11} CTC_i + \beta_{12} CHW_i + \varepsilon_{ij} \quad \text{(Eq. 2)}$$

$MNCH_i$ is an indicator variable denoting whether a facility belongs to the comparison or intervention group. The model includes four interaction terms. $Time_{ij}$*$Post_{ij}$ accounts for any difference in the intervention and pre-intervention trend in the comparison group. $Time_{ij}$*$MNCH_i$ allows for different time trends for intervention and comparison groups. $MNCH_i$*$Post_{ij}$ indicates differential changes in the average number of facility deliveries in intervention and comparison groups in the immediate post-period. $Time_{ij}$*$MNCH_i$*$Post_i$ is a three-way interaction term to account for a possible difference in the rate of change in the average number of facility deliveries in intervention and comparison groups between pre-intervention and intervention periods. $Month_{ij}$ was again included in the adjusted model to account for seasonality. Several facility-level time invariant explanatory covariates with the potential to influence the outcome of interest were also included in the adjusted model: facility type (dispensary or health center); facility ownership (government or faith-based); HIV CTC service availability at the facility; and number of CHWs reporting to the facility. Robust estimation of standard errors guarded against misspecification of the working correlation structure and corrected for overdispersion (Liang and Zeger, 1986).

Results Interpretation

Regression results are reported as incidence rate ratios (IRR) with 95% confidence intervals. In Equation 1, for single-group ITS, the pre-intervention trend in hospital facility deliveries is projected into the intervention period to serve as the estimated counterfactual trend. Model coefficients are interpreted as: β_0 is the intercept, or number of facility deliveries at time=0; β_1 is the pre-intervention slope prior to introduction of MNCH training; β_2 is the change in level in the period immediately following the MNCH training (compared to the counterfactual); and β_3 indicates the difference between the pre-intervention and intervention slopes. Significant *p*-values for either β_2 or β_3 coefficients indicate a treatment effect of the intervention on facility deliveries, immediately (β_2 level) and/or gradually over time (β_3 slope) (Linden and Adams, 2011).

In the multiple group ITS denoted by Equation 2, interpretation of β_0 to β_3 coefficients remains similar to the interpretation of Equation 1 for the comparison group, whereas β_4 to β_7 relate to the intervention group. β_4 is the difference in the level and β_5 is the difference in the slope between intervention and comparison facilities prior to the MNCH training. Therefore, non-significant *p*-values for the β_4 and β_5 coefficients indicate the comparison and intervention groups were balanced at baseline in terms of the level and slope of the outcome variable, respectively. β_6 is the difference in the level between the intervention and comparison groups immediately following initiation of the intervention. β_7 is the difference between intervention and comparison group slopes during the intervention compared to the difference in slopes pre-intervention. Significant *p*-values for either β_6 or β_7 coefficients denote a treatment effect following introduction of MNCH training, immediately (β_6 level) and/or gradually over time (β_7 slope).

Model Assumptions and Diagnostics

A population offset was not included in the models under the assumption that facility catchment areas were relatively stable over time, with the number of pregnancies assumed constant over time. Model diagnostics included examination of residual versus fitted plots and quasi-likelihood information criterion (QIC) to identify the most appropriate working correlation structure (Appendix 6) (Cui, 2007). All statistical analyses were run in Stata Version 13 (StataCorp, 2013).

Ethical Considerations

Ethical clearance for this study was jointly approved by the Institutional Review Boards of Johns Hopkins School of Public Health in Baltimore, MD (IRB No. 00005497) and Muhimbili University of Health and Allied Sciences in Dar es Salaam, Tanzania (Ref. No. 2015-12-18/AEC/Vol. X/94). Approval for use of Iringa's routine HMIS data was granted by the Permanent Secretary of Tanzania's Ministry of Health.

Results

Sample Characteristics

The final sample consisted of 2 hospitals, 10 health centers, and 56 dispensaries (N=68). Facility characteristics are presented for health centers and dispensaries in Table 1, which included 32 facilities (49%) in the comparison group and 34 facilities (51%) in the intervention group. Most facilities were government owned (79%) and supported by a mean 2.2 CHWs (*SD*=1.7). Nearly a third (30%) of facilities were designated HIV CTC sites. Facilities had an average 1.6 delivery beds (*SD*=1.1), serving an expected 14 pregnancies per month (*SD*=11.3). Facilities were located a median of 35 KM from the nearest referral point (*IQR* 20-65).

Bivariate Analyses: Intervention vs. Comparison Facilities

Bivariate analyses revealed statistically significant differences in facility type and HIV CTC availability among intervention and comparison groups (Table 1). Health centers were more common among the intervention than comparison facilities (24% vs. 6%; *p*=.05). Intervention facilities were more likely to offer CTC services than comparison facilities (41% vs. 19%, *p*=.05).

Bivariate Analyses: Intervention vs. Comparison Facilities, Stratified by District

Bivariate analyses suggested sufficient comparability between intervention and comparison groups by district, with no significant differences in terms of facility type, ownership, distance to nearest referral point, beds and delivery beds per facility, and expected pregnancies per month (Table 2). However, intervention facilities in Kilolo were more likely to provide CTC services than comparison facilities (37.5 vs. 0%, p=.01), a difference less pronounced in Iringa Rural (44% vs. 32%,

p=.42), but remained statistically significant in the full sample (41% vs. 19%, *p*=.05) (Table 2).

Bivariate Analyses: Comparing Districts – Iringa Rural vs. Kilolo

Facilities were similar across districts in terms of type, ownership, HIV CTC service availability, distance to nearest referral point, beds and delivery beds per facility, and expected pregnancies per month (Table 2). A key difference was the greater mean number of overall CHWs per facility in Kilolo compared to Iringa Rural (2.8 vs. 1.8, *p*=.04), a difference also reflected in the comparison of dual role CHWs per facility (1.3 vs. 0.6, *p*=.04).

Time Series Characteristics

The time series dataset consisted of 2,448 observations for facility delivery count from January 2014 through December 2016. There were 1,414 observations (58%) pre-intervention and 1,034 observations (42%) during the intervention, averaging 20.8 and 15.2 months of data, respectively. In Iringa Rural, there were 23 months of pre-intervention data and 13 months of intervention data, whereas in Kilolo there were 18 months of data in both the pre-intervention and intervention.

Intervention Effect on Facility Deliveries

Results are first presented at the health center / dispensary-level for intervention and comparison groups, followed by the hospital-level, and then for the districts as a whole.

Health Center / Dispensary-level Models: Multiple Group ITS

On average, health centers and dispensaries performed less than 10 deliveries per month (*M*=8.2, *SD*=6.2, Range: 0-45). During pre-intervention in Iringa Rural, the mean number of deliveries at intervention facilities was greater than at comparison facilities (9.5 vs. 7.3, *p*<.001), with a gradual increase in facility deliveries over time (Table 3; Figure 4). Similarly, during pre-intervention in Kilolo, intervention facilities on average delivered more babies per month than comparison facilities (9.9 vs. 6.5, *p*<.001), with a relatively flat trend over time (Table 3; Figure 4). Intervention and comparison facilities were considered sufficiently similar at baseline, given the relatively low volume of facility deliveries and the parallel pre-intervention delivery trends.

In comparison facilities, there was a small, but significant decrease in average facility deliveries during the intervention period in both Iringa Rural and Kilolo, whereas there was no change in average deliveries observed at intervention facilities over time (Table 3). Given the already low volume of facility deliveries, this finding translated to one fewer delivery per month at comparison facilities during the intervention.

After adjusting for secular trends, seasonality, and facility covariates in the multiple group ITS analysis, we failed to reject the null hypothesis of no difference in the change in level (β_6) or change in slope (β_7) in the mean facility delivery count after the intervention began. The time series plots depict a gradually decreasing slope in facility deliveries for both intervention and comparison groups during the intervention (Figure 4). However, the monthly volume of facility deliveries remained stable over time, and the changes in slope following intervention were not significant in either district (Table 4).

Hospital Models: Single group ITS

The hospital in Iringa Rural demonstrated a statistically significant increase of 32 deliveries per month (95% CI: 14.2, 49.5; $p<.001$), from a mean of 202 deliveries per month pre-intervention to 234 during intervention (Table 3). After adjusting for secular trends and seasonality in the ITS analysis, a gradual, but significant decline in the slope of monthly hospital deliveries was evident pre-intervention (aIRR: 0.99, 95% CI: 0.98-0.99, $p=.003$) (Table 5; Figure 5). This was followed by a statistically significant 36% jump at the change point (aIRR: 1.36, 95% CI: 1.19-1.55, $p<.001$) and a flat trend thereafter throughout the intervention (aIRR: 1.01, 95% CI: 0.99-1.01, $p=.95$). One year after the intervention began, the ITS model predicted 254 deliveries per month at the Iringa Rural hospital, representing a 22.0% increase since the intervention launched.

At the hospital in Kilolo there was a statistically significant increase of 27 deliveries per month (95% CI: 14.8, 39.1; $p<.001$), from a mean of 167 deliveries per month pre-intervention to 194 hospital deliveries per month during intervention (Table 3). After adjusting for seasonality, the number of hospital deliveries remained flat during pre-intervention (aIRR: 1.0, 95% CI: 0.99-1.00, $p=.36$) with no immediate jump at the change point when the intervention began (aIRR: 1.03, 95% CI:

0.97-1.10, p=.32) (Table 5; Figure 5). During the intervention, there was a statistically significant increase in the slope of hospital deliveries compared to the expected counterfactual in the absence of the intervention (aIRR: 1.02, 95% CI: 1.01-1.02, p<.001). One year after the intervention launched, the ITS model predicted an estimated 194 deliveries per month at the Kilolo hospital, representing a 21.6% increase since the intervention began. The time series plots in Figure 5 visually confirm data patterns reflected by the ITS output for Iringa Rural and Kilolo.

District-Level: Proportion of Hospital Deliveries out of Total Facility Deliveries

Within each district, the total volume of facility deliveries summed across all sites (including non-program facilities without single or dual role CHWs) was examined alongside the proportion of hospital deliveries out of total facility deliveries (Table 6). The average number of facility deliveries in Iringa Rural increased by 1% (average of 6.6 additional deliveries per month) (95% CI: 3.8, 9.5; p<.001), from 687.6 during pre-intervention months to 694.2 during intervention months (Table 6). A similar 1.3% increase was observed in Kilolo, where facility deliveries increased by an average of 6.3 additional deliveries per month (95% CI: 3.7, 8.9; p<.001), from 496.6 to 502.9 deliveries in pre-intervention and intervention periods, respectively. In the time series plots of total facility deliveries, trends appear relatively stable over time in both Iringa Rural and Kilolo, consistent with the small relative increase in monthly facility delivery volume during the intervention period (Figure 6).

The percent of deliveries at the hospital (out of total facility deliveries in each district) increased by 4.3% (95% CI: 2.3, 6.3; p<.001) in Iringa Rural, from 29% pre-intervention to 34% during intervention, a 14.7% relative increase (Table 6; Figure 6). Similarly, in Kilolo the percent of deliveries increased by 4.9% (95% CI: 2.7, 7.2; p<.001), from 34% pre-intervention to 39% during intervention, a 17.2% relative increase (Table 6, Figure 6).

Discussion

Evidence from this study suggests dual role CHWs were successful at mobilizing pregnant women to deliver at hospitals: One year after the integrated CHW model was introduced, the number of deliveries per month increased by 22% in both Kilolo and Iringa Rural district hospitals. There was no measurable change in the average number of facility deliveries at health centers and dispensaries,

although a slight but insignificant downward trend in deliveries was observed during the intervention in both districts.

Iringa Region is unique among low income, rural areas in Tanzania for attaining high coverage of facility deliveries. The most recent 2015-16 DHS survey suggests only 10% of pregnant women in Iringa Region do not deliver in health facilities, an impressive achievement considering that nationally roughly 40% of deliveries still occur at home (Tanzania MoHCDGEC *et al.*, 2016). A recent study in Iringa Rural found that women who delivered at home were less educated, lived further from the clinic, and started antenatal care after their first trimester (Straneo *et al.*, 2016). Other studies in Tanzania have found women of lower socioeconomic status and multiparous women are much less likely to deliver in facilities (Ndao-Brumblay *et al.*, 2013; Exavery *et al.*, 2014). Even in areas of high facility delivery coverage, additional approaches are needed to reach the remaining underserved women. Strategies delivered at the community-level could be critical for accessing the hardest-to-reach pregnant women, or so-called last 10% that would otherwise deliver at home.

The implementing partner's stated goal of introducing community-level MNCH promotion was to increase utilization of antenatal care and facility deliveries. Results of this study suggest that the intended pathway of the intervention was effective at promoting facility delivery. Through household visits and community mobilization, dual role CHWs provided MNCH education on the importance of antenatal care, facility delivery, and postnatal care. CHWs were trained to identify danger signs and refer pregnant women with potential complications for facility delivery at health centers or hospitals. Since dual role CHWs were already well known and respected by their communities for their existing HIV role, they were well positioned to identify MNCH clients and urge them to attend the facility for delivery services. As trusted members of the community, dual role CHWs could provide MNCH education and help further increase social expectations around facility delivery, as well as the importance of developing an individualized birth plan and preparing for complications.

These study findings are in line with previous research showing community involvement to be effective in improving antenatal and delivery care through safe motherhood promotion in Mtwara

Region, Tanzania (Mushi *et al.*, 2010). A survey in Morogoro Region, Tanzania revealed no association between CHW counseling and facility delivery, but found women that returned for postnatal care at facilities were more likely to have been counseled by CHWs, suggesting a role for client engagement to keep women retained along the continuum of care (Mohan *et al.*, 2017). In Uganda, community systems strengthening via mobilization, male partner access clubs, and music and drama groups helped increase antenatal care utilization and facility deliveries (Ediau *et al.*, 2013). While evidence from systematic reviews suggest community-based interventions can significantly improve referral to a health facility for complications during pregnancy, delivery, or postpartum (RR 1.40; 95% CI: 1.19, 1.65), there is limited evidence of such interventions also increasing skilled birth attendance (RR 1.46; 95% CI: 0.62, 3.43) or institutional deliveries (RR 1.28; 95% CI: 0.98, 1.67) (Lassi *et al.*, 2010).

Bypassing for Childbirth Services

Total facility deliveries remained fairly stable overall, increasing by about 6 additional facility deliveries per month in each district, translating to a small relative increase of 1.0% in Iringa Rural and 1.3% in Kilolo – which equates to closing roughly 10% of the coverage gap in facility deliveries. However, the relative increase in the proportion of facility deliveries at hospitals was much greater: 14.7% in Iringa Rural and 17.2% in Kilolo. Delivery services are available at dispensaries, health centers, and hospitals, but the increase in facility deliveries was only observed at the hospital level. In health centers and dispensaries, which account for roughly two-thirds of deliveries occurring at facilities, there were downward trends in the average number of facility deliveries per month during the intervention, although not significant. Taken together, these findings may be suggestive of bypassing behavior, whereby a patient skips their nearest primary health care facility to seek out services at a more distant or higher-level facility (Akin and Hutchinson, 1999).

In Tanzania, women who have not experienced prior obstetric complications are expected to attend their nearest health center or dispensary for delivery services, while those considered “high risk” or with prior complications are referred to hospitals (Mkoka *et al.*, 2014; Kante *et al.*, 2016). However, the low staffing and delivery caseload at dispensaries limits their ability to provide higher

quality childbirth services (Hanson *et al.*, 2013). There is growing evidence to document bypassing for childbirth services in Tanzania, with bypassing rates ranging from 42% in Western Tanzania (Kigoma Region) and the coastal areas (Pwani Region), up to 64% in Southern Tanzania (Morogoro Region) (Kruk *et al.*, 2009, 2014; Kante *et al.*, 2016). Increased bypassing in Tanzania has been significantly associated with primigravid status, previous birth complications, perception of low quality of care at the local clinic, wealth, and staying at maternity waiting homes, whereas decreased bypassing has been associated with recent infrastructure renovations and availability of ≥ 4 obstetric signal functions at the local clinic (Kruk *et al.*, 2009, 2014; Kante *et al.*, 2016). Increased bypassing for childbirth may have been an unintended consequence of this intervention.

Policy and Practice Implications

Roughly half of volunteer CHW programs in Tanzania are either HIV or MNCH focused. The results of this study are therefore highly relevant to ongoing implementation decisions around CHW programming in Tanzania, where further integration of HIV and MNCH services at the community-level would seem to be warranted. The findings support previous evidence that community-level strategies show promise in improving MNCH access. Use of CHWs to reach women with targeted health messaging about facility delivery is one key strategy for improving utilization, particularly for reaching the most underserved community members. By virtue of their position in the community, CHWs are well placed to educate pregnant women on the unpredictable nature of birth complications and the importance of facility delivery.

Poor quality of care, particularly at dispensaries, is widely documented across Tanzania and has been found to influence facility delivery (Rockers *et al.*, 2009; Hanson *et al.*, 2013; Tancred *et al.*, 2016). There is a positive association between rural women giving birth in a facility and quality of care (Armstrong *et al.*, 2016). Facilities with low delivery caseloads, as reported by most facilities in this study (<10 deliveries per month), are likely suboptimal for skills retention, economies of scale, and patient safety, calling into question whether the number of delivery sites should be reduced in an effort to improve quality of care (Straneo *et al.*, 2014, 2017). The majority of births still occur in rural primary health care facilities, not hospitals, but hospitals are better equipped to manage childbirth

complications in terms of staffing, supplies, equipment, and service availability – therefore, the increase in the proportion of facility deliveries occurring at hospitals in this study is a positive finding, provided hospitals are equipped to deal with the increased demand.

More research is necessary to understand the effect of dual role CHWs on patterns of service utilization, including around bypassing decision making. It would be useful to explore the extent to which bypassing decisions are attributable to efforts by dual role CHWs, and determine whether adjustments are necessary in the content of MNCH education and promotion delivered by dual role CHWs. As the HIV epidemic stabilizes in Tanzania, there may be additional opportunities for integration of HIV and MNCH through leveraging the estimated 7,000 existing HIV-focused CHWs volunteering across the country (MUHAS and JHSPH, 2015). Prior to expansion of the integrated CHW model, more research into implementation context is necessary to determine the drivers of program acceptability, feasibility, and adoption, as well as recommended program adjustments.

Strengths and Limitations

A major strength of this study was use of a longitudinal quasi-experimental study design, which improves confidence in the internal validity of the findings. In the multiple ITS analysis, the use of comparison facilities helped limit the extent to which co-occurring events or initiatives could explain the observed trends in deliveries at health centers and dispensaries (Biglan *et al.*, 2000). While there was no comparison facility at the hospital level, interventions were introduced five months apart in Kilolo and Iringa Rural, which produced a multiple baseline design in adjacent districts. This design strengthened confidence that the intervention was responsible for the observed change in hospital deliveries, and reduced the likelihood that concurrent events could explain the results (Biglan *et al.*, 2000). Interestingly, there were different patterns of intervention effect by district. In Kilolo, hospital deliveries increased gradually throughout the intervention, whereas in Iringa Rural an initial jump in hospital deliveries was sustained over time. The patterns of intervention effect could be related to implementation differences between the two districts. Since Kilolo started the intervention five months before Iringa Rural, there may have been shared learning or experience from the initial implementation efforts transferred to Iringa Rural.

Nonetheless, alternative pathways should be considered, particularly in light of the large donor presence in Iringa Region and the potential for other MNCH programs to produce improvement in facility deliveries. For example, supply-side interventions to improve quality of antenatal and delivery care could also affect service utilization. While our research team did not conduct a comprehensive review of ongoing programs in Iringa aimed at MNCH service utilization, informal discussions with the civil society organizations, implementing partner, and district medical officers did not reveal other large-scale, district-wide programs, for MNCH service utilization, from either the supply or demand side.

Results of this research should be interpreted in light of several limitations. ITS analyses are subject to several additional threats to internal validity, including instrumentation, instability, and selection (Biglan *et al.*, 2000). Since the outcome measure relied on a routinely collected metric from facilities, with no change in the data collection instrument, instrumentation threats are unlikely. In fact, there are several benefits to using HMIS data in causal inference evaluations of health interventions. These include numerous repeated observations available over extended periods of time, coverage across nearly all facilities, real-time data availability, and multiple indicators of service utilization (Wagenaar *et al.*, 2016). Missing data was surprisingly infrequent over the three-year time frame (3.3%). Data instability (noise) can be problematic for detecting an intervention effect (Biglan *et al.*, 2000). Variability in the hospital-level data was more apparent in Iringa Rural than Kilolo. However, the extended baseline (23 months) in Iringa Rural helped establish confidence in the pre-intervention trend. Selection refers to any preexisting differences between the intervention and comparison facilities that could account for the experimental effect (Biglan *et al.*, 2000). The average number of deliveries was slightly higher at intervention than comparison facilities, but the overall delivery volume across health centers and dispensaries was generally very low. In addition, health centers were more likely to be in the intervention than comparison group.

This research did not assess health outcomes, so while community mobilization efforts may have increased the uptake of hospital deliveries, we could not measure whether this resulted in better maternal and neonatal health outcomes. Several contextual characteristics of Iringa Region, including

the high facility delivery coverage and elevated HIV prevalence, may limit the generalizability of study findings to other areas of Tanzania.

Conclusion

In a rural context with high facility delivery coverage (~90%) such as Iringa, the increase in hospital deliveries suggests community-level health promotion efforts to encourage facility delivery may be effective, particularly for reaching the last 10% of pregnant women who would otherwise deliver at home. Results showed a slight, although insignificant, downward trend in facility deliveries at health centers and dispensaries, while an increase in deliveries was notable at the hospital level. In conjunction with findings from Manuscript 1 that dual role CHWs were able to manage both HIV and MNCH responsibilities, this study suggests MNCH education and promotion by CHWs effectively encouraged facility deliveries and may have contributed to increased deliveries at the hospital-level.

Chapter 3 References

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Figures and Tables

Figure 1a. Time trends (1991-2010) in proportion of births in Tanzania delivered at facilities and place of delivery by urban/rural residence (Reproduced from Afnan-Holmes *et al.*, 2015).

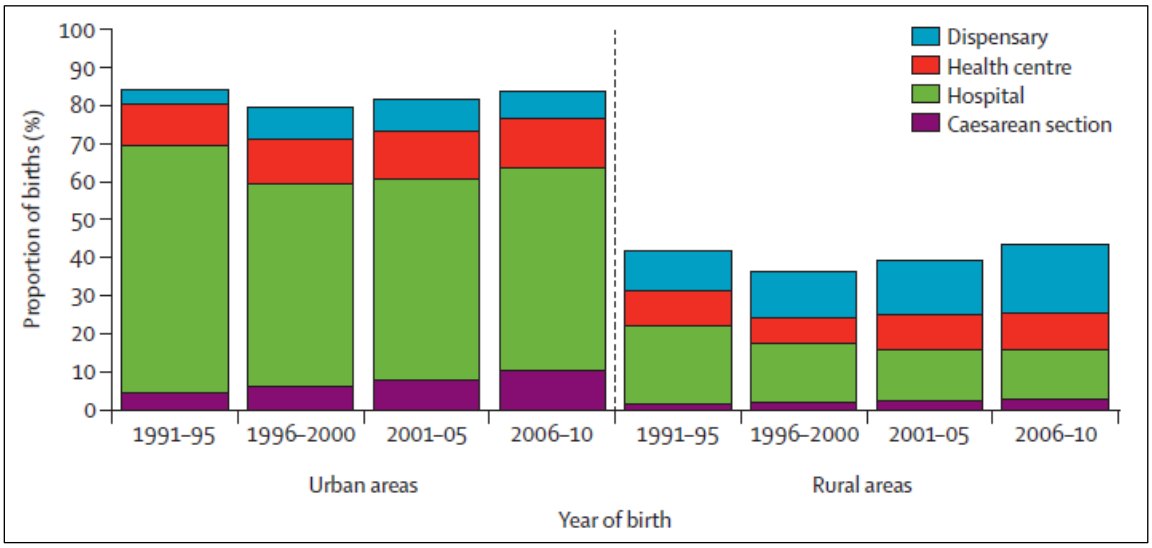
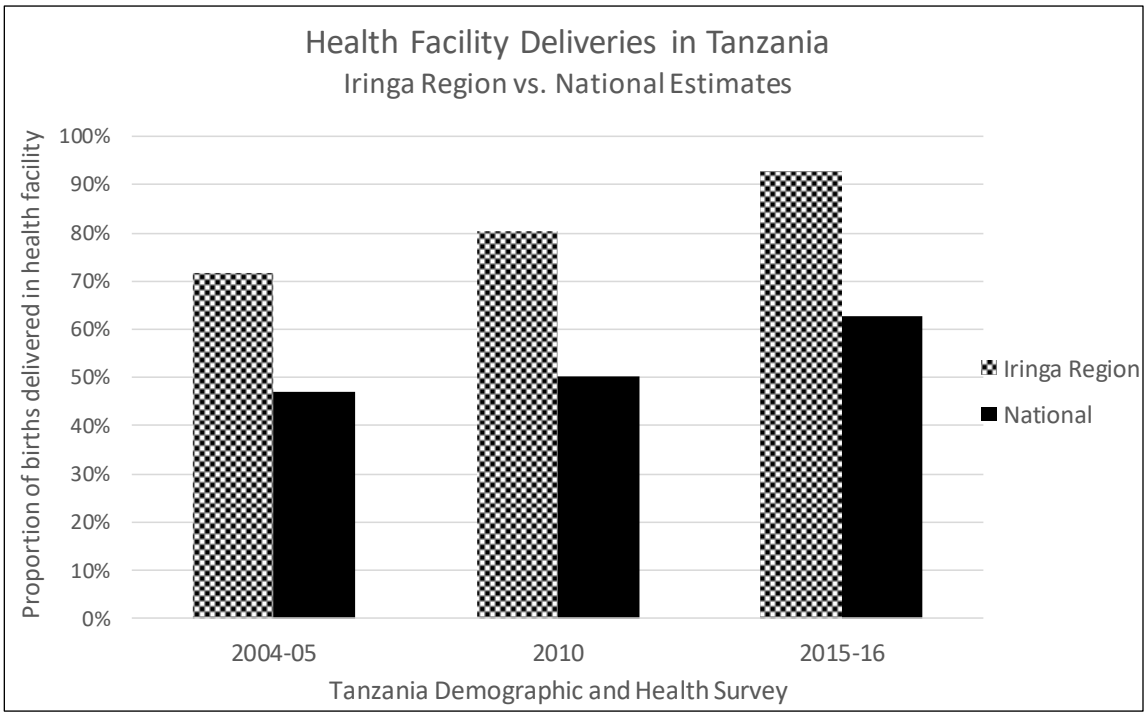
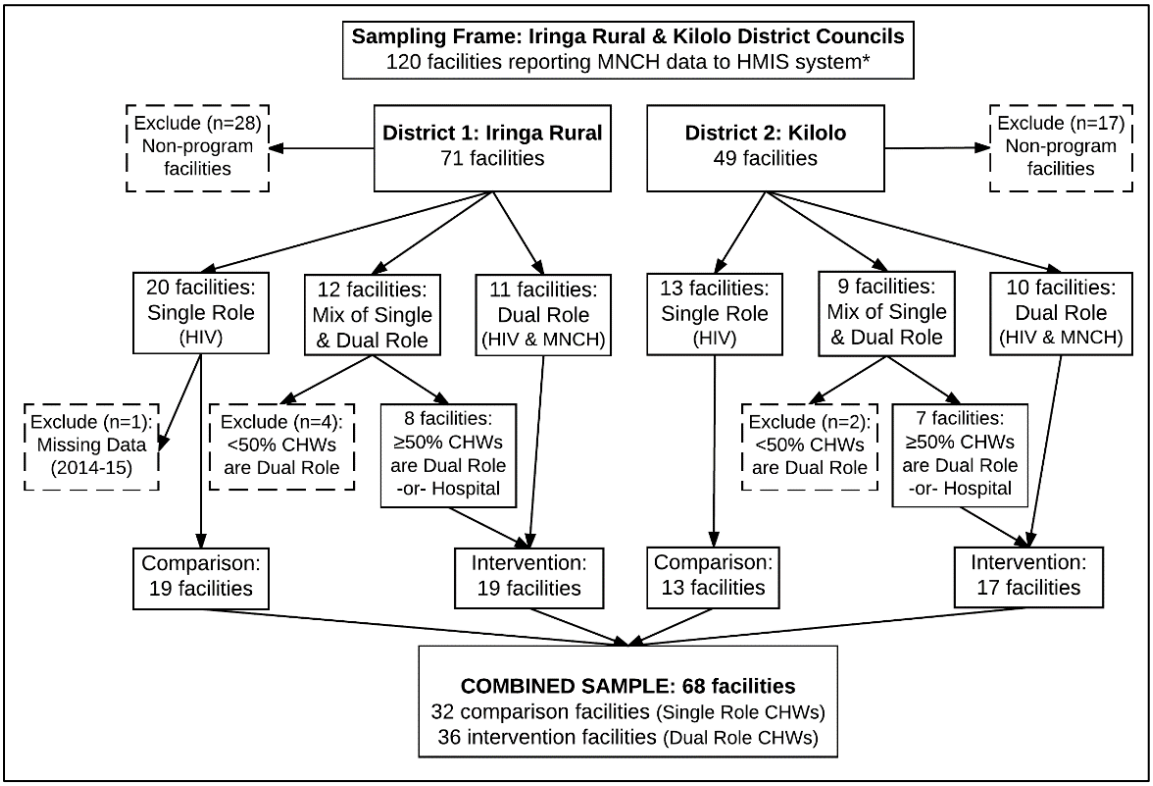


Figure 1b. Proportion live births delivered at health facilities in Iringa Region and nationally.



(Tanzania NBS and ORC Macro, 2005; Tanzania NBS and ICF Macro, 2011; Tanzania MoHCDGEC *et al.*, 2016)

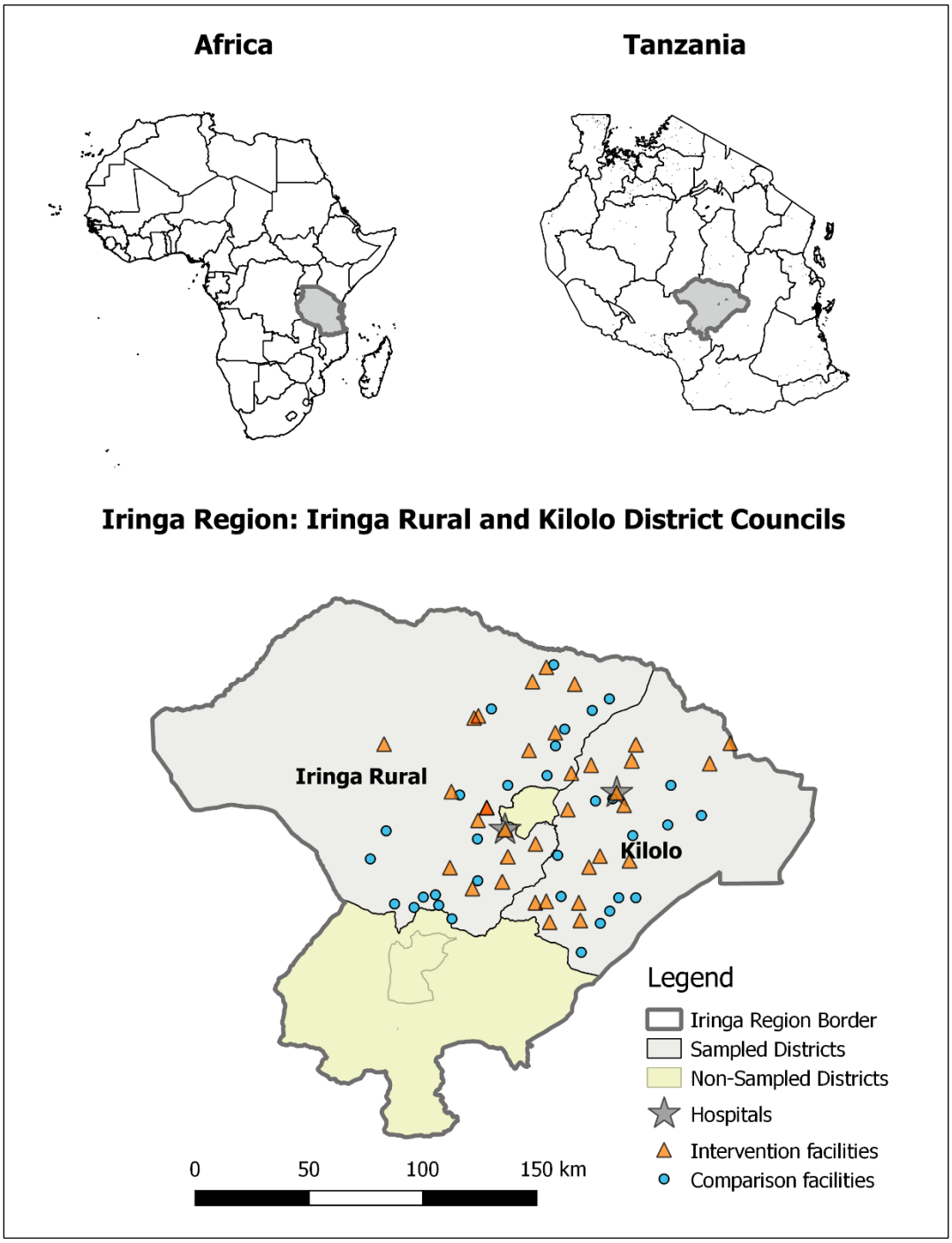
Figure 2. Schematic of facilities selected for inclusion from Iringa Rural and Kilolo Districts.



*The HMIS databased contained 143 facilities in total for Iringa Rural and Kilolo District Councils, of which 23 (16%) facilities were excluded from the sampling frame due to MNCH data not reported to the HMIS system 2014-16:

- 6 (4.2%) were public facilities
- 6 (4.2%) were private facilities, for-profit or non-governmental organization
- 6 (4.2%) were private facilities, operated by faith-based organizations
- 1 (0.6%) was a public parastatal facility located in a national park
- 2 (1.4%) were verified "closed" facilities per Tanzania's health facility registry (Tanzania MoHSW, 2015)
- 2 (1.4%) could not be verified by Tanzania's health facility registry

Figure 3. Map of Africa, Iringa Region in Southwestern Tanzania, and location of the intervention and comparison facilities in Iringa Rural and Kilolo District Councils.



Maps were generated using QGIS Version 2.18 (QGIS Development Team, 2017). Country, regional and district boundaries were sourced from Tanzania's National Bureau of Statistics (Tanzania National Bureau of Statistics, 2013). Coordinates for health facilities were sourced from an online health facility registry maintained by Tanzania's Ministry of Health (Tanzania MoHSW, 2015).

Figure 4. Time series plot of mean monthly facility deliveries at intervention and comparison facilities, by district.

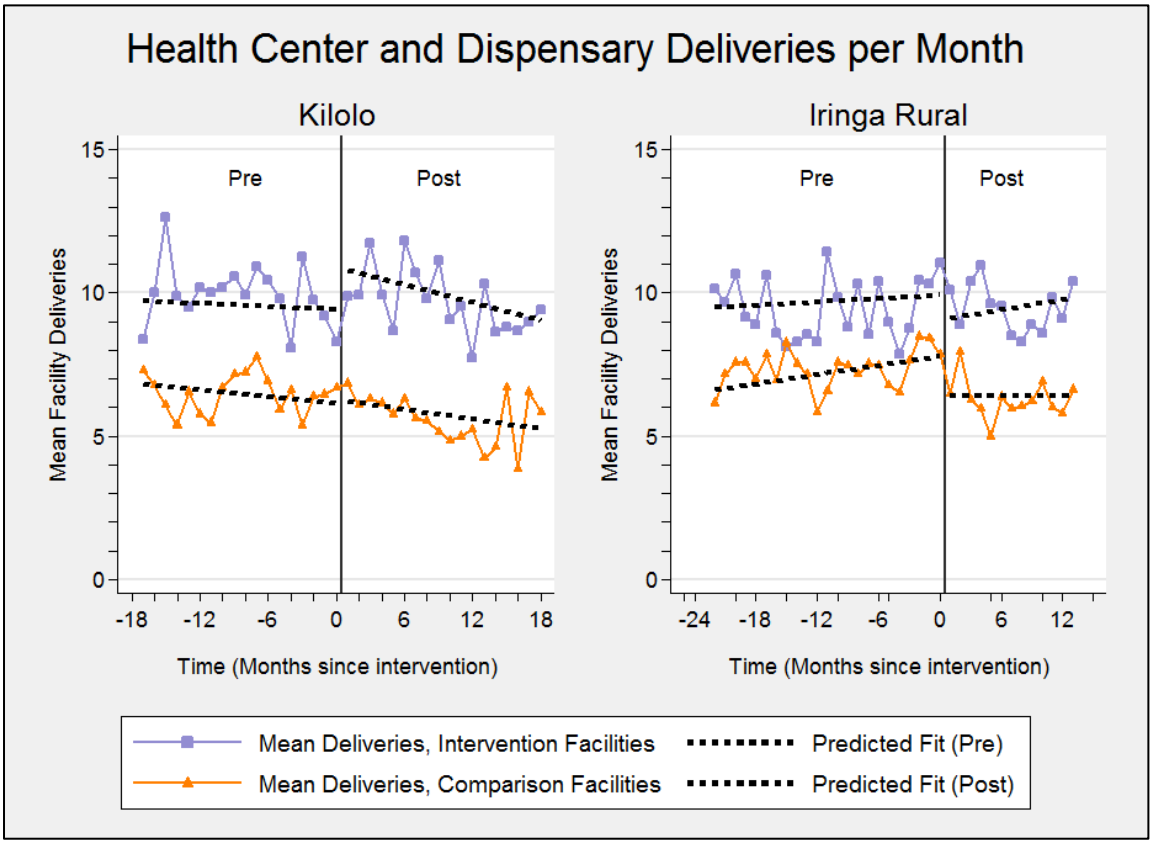


Figure 5. Time series plot of monthly facility deliveries at the district hospital, by district.

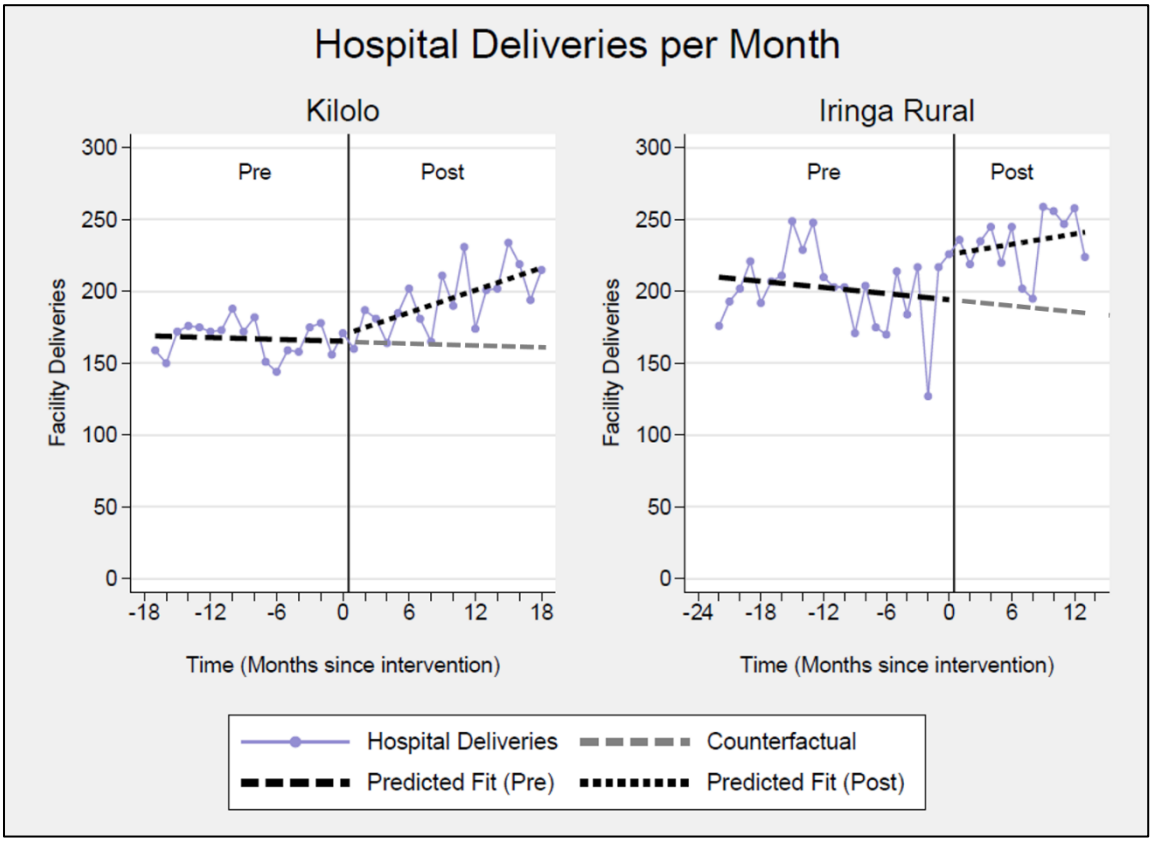


Figure 6. Total facility deliveries per month and proportion of deliveries occurring at hospitals out of all facilities, by district.

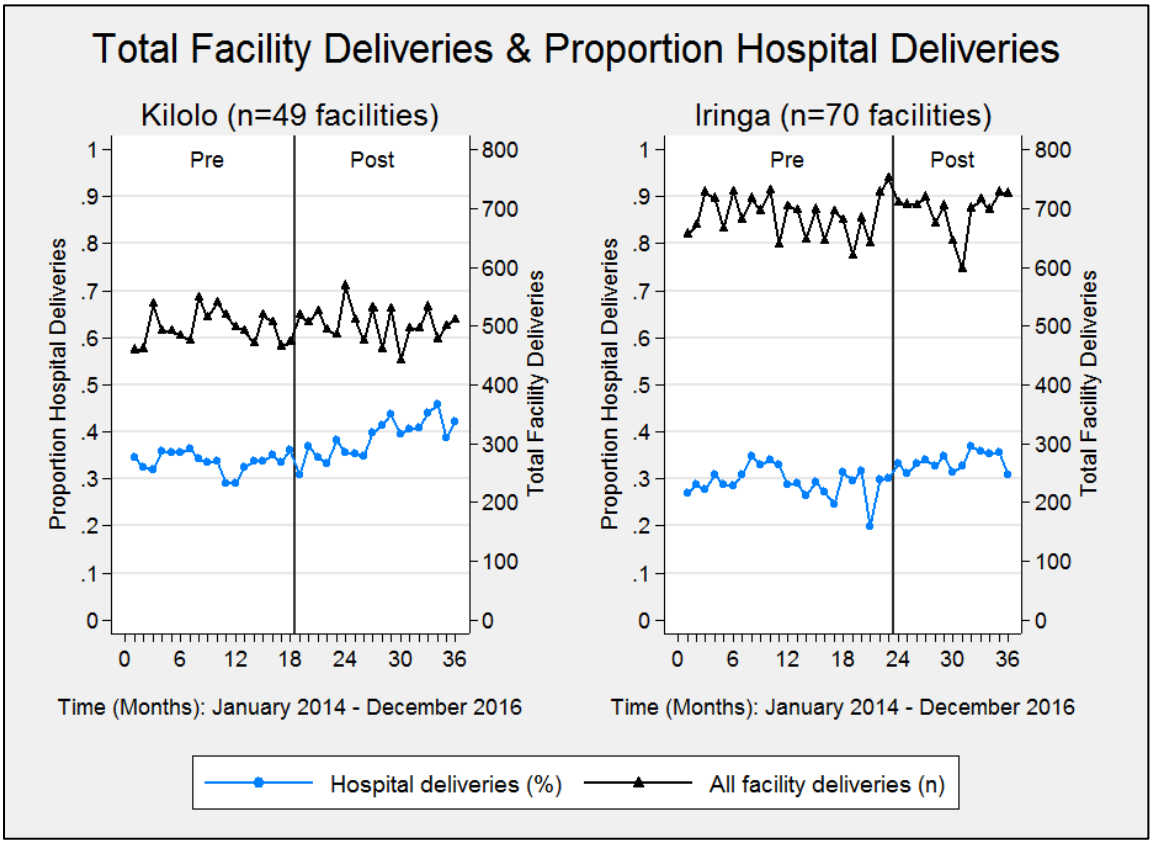


Table 1. Facility characteristics for all facilities and intervention versus comparison groups.

	All sites†	**Comparison**	**Intervention**	
	N=66; 100%	*n*=32; 49%	*n*=34; 51%	
Facility Characteristics	**Mean ± SD; or n (%)**			***p***
Supervisory facility type*				
Dispensary	56 (84.8)	30 (93.7)	26 (76.5)	0.05
Health Center	10 (15.2)	2 (6.3)	8 (23.5)	
Supervisory facility ownership				
Government	52 (78.8)	25 (78.1)	27 (79.4)	0.90
Faith-Based	14 (21.2)	7 (21.9)	7 (20.6)	
HIV treatment services*				
Adult and pediatric CTC site	20 (30.3)	6 (18.9)	14 (41.2)	0.05
Total CHWs per facility	2.2 ± 1.7	2.2 ± 1.6	2.2 ± 1.7	0.97
Dual Role CHWs per facility***	0.9 ± 1.4	0.0 ± 0.0	1.8 ± 1.4	0.00
Distance to referral point (km)	41.7 ± 27.4	42.3 ± 26.1	41.2 ± 29.0	0.87
Expected pregnancies per month	14.1 ± 11.3	13.0 ± 12.7	15.0 ± 10.0	0.48
Beds per facility	8.4 ± 11.9	8.1 ±12.6	8.6 ± 11.4	0.86
Delivery beds per facility	1.6 ± 1.1	1.4 ± 1.2	1.8 ± 1.0	0.38

Significant at: *p <0.05; **p <0.01; ***p <0.001
†Hospitals excluded from facility characteristics comparison

Table 2. Facility characteristics by district and intervention versus comparison groups within each district.

	All sites†	District 1	District 2		District 1: Iringa Rural (*n*=37) Comparison	District 1: Iringa Rural (*n*=37) Intervention		District 2: Kilolo (*n*=29) Comparison	District 2: Kilolo (*n*=29) Intervention	
	N=66; 100%	*n*=37; 56%	*n*=29; 44%		*n*=19; 51%	*n*=18; 49%		*n*=13; 45%	*n*=16; 55%	
Facility Characteristics	**Mean ± SD; or n (%)**			***p***	**Mean ± SD; or n (%)**		***p***	**Mean ± SD; or n (%)**		***p***
Facility type										
Dispensary	56 (84.8)	29 (78.4)	27 (93.1)	0.10	17 (89.5)	12 (66.7)	0.09	13 (100.0)	14 (87.5)	0.19
Health Center	10 (15.2)	8 (21.6)	2 (6.9)		2 (10.5)	6 (33.3)		0 (0.0)	2 (12.5)	
Facility ownership										
Government	52 (78.8)	31 (83.8)	21 (72.4)	0.26	15 (79.0)	16 (88.9)	0.41	10 (76.9)	11 (68.7)	0.62
Faith-Based	14 (21.2)	6 (16.2)	8 (27.6)		4 (21.0)	2 (11.1)		3 (23.1)	5 (31.3)	
HIV treatment services*										
Adult & pediatric CTC site	20 (30.3)	14 (37.8)	6 (20.7)	0.13	6 (31.6)	8 (44.4)	0.42	0 (0.0)	6 (37.5)	0.01
Total CHWs*	2.2 ± 1.7	1.8 ± 0.9	2.8 ± 2.2	0.04	1.9 ± 0.9	1.7 ± 0.8	0.34	2.6 ± 2.3	2.9 ± 2.2	0.76
Dual Role CHWs***	0.9 ± 1.4	0.6 ± 0.7	1.3 ± 1.8	0.04	0.0 ± 0.0	1.2 ± 0.4	0.00	0.0 ± 0.0	2.4 ± 1.8	0.00
Distance to referral (km)	41.7 ± 27.4	40.3 ± 28.5	43.5 ± 26.4	0.64	44.4 ± 26.7	36.0 ± 30.3	0.38	39.2 ± 26.0	47.0 ±27.0	0.44
Expected pregnancies / mo.	14.1 ± 11.3	12.5 ± 6.6	16.1 ± 15.3	0.23	11.6 ± 6.5	13.4 ± 6.8	0.41	15.2 ± 18.6	16.9 ± 12.6	0.77
Beds per facility	8.4 ± 11.9	8.1 ± 11.2	8.7 ± 12.9	0.85	9.0 ± 14.3	7.1 ± 6.5	0.61	6.8 ± 10.1	10.2 ± 15.0	0.48
Delivery beds per facility*	1.6 ± 1.1	1.8 ± 1.3	1.3 ± 0.6	0.05	1.6 ± 1.5	2.1 ± 1.2	0.23	1.2 ± 0.4	1.4 ± 0.6	0.32

Significant at: *p <0.05; **p <0.01; ***p <0.001
†Hospitals excluded from facility characteristics comparison

Table 3. Mean number of facility deliveries per month in the pre-intervention and intervention periods stratified by district, for hospitals and health centers / dispensaries in the intervention versus comparison groups.

Facility Deliveries	Pre-Intervention Mean (95% CI)	Intervention Mean (95% CI)	Difference Mean (95% CI)	Relative Change
Hospitals				
District 1: Iringa Rural	202.1 (190.4, 213.9)	233.9 (221.4, 246.5)	31.8 (14.1, 49.5) ***	15.7%
District 2: Kilolo	167.3 (161.2, 173.3)	194.2 (183.2, 205.2)	26.9 (14.8, 39.1) ***	16.1%
Health Centers / Dispensaries				
District 1: Iringa Rural				
All facilities	8.4 (7.9, 8.8)	7.8 (7.3, 8.4)	-0.54 (-1.26, 0.17)	-7.1%
Comparison group	7.3 (6.7, 7.9)	6.3 (5.6, 7.0)	-1.06 (-0.11, -2.00) *	-13.7%
Intervention group	9.5 (8.8, 10.1)	9.5 (8.6, 10.3)	0.00 (-1.05, 1.04)	0.0%
District 2: Kilolo				
All facilities	8.4 (7.8, 8.9)	7.9 (7.4, 8.3)	-0.53 (-1.26, 0.21)	-6.0%
Comparison group	6.5 (6.0, 7.0)	5.6 (5.2, 5.9)	-0.88 (-1.48, -0.28) **	-13.8%
Intervention group	9.9 (9.0, 10.8)	9.7 (9.0, 10.5)	-0.23 (-1.40, 0.94)	-2.0%

Significant at: *p <0.05; **p <0.01; ***p <0.001
CI, confidence interval

Table 4. Health Center / Dispensary-level model: Multiple group interrupted time series estimates, by district**,** unadjusted and adjusted models.

Facility Deliveries	**District 1: Iringa Rural**		**District 2: Kilolo**	
Interrupted Time Series Parameters	**IRR (95% CI)**	**Adj. IRR (95% CI)**	**IRR (95% CI)**	**Adj. IRR (95% CI)**
Intercept, Comparison group (β_0)	7.81 (5.43–11.25) ***	6.57 (4.05–10.66) ***	6.17 (4.56–8.34) ***	5.12 (3.93–6.67) ***
Pre: Comparison group slope (β_1)	1.01 (0.99–1.02)	1.01 (1.00–1.02) *	0.99 (0.98–1.00)	1.00 (0.99–1.01)
Immediate post: Difference in comparison group level (β_2)	0.82 (0.65–1.04)	0.72 (0.59–0.89) **	1.02 (0.75–1.40)	0.98 (0.76–1.26)
Post vs pre: Difference in comparison group slope (β_3)	0.99 (0.97–1.01)	0.99 (0.98–1.01)	1.00 (0.98–1.01)	0.99 (0.98–1.01)
Pre: Difference intervention vs. comparison intercept (β_4)	1.27 (0.76–2.11)	1.02 (0.70–1.50)	1.53 (1.00–2.33) *	1.15 (0.83–1.60)
Pre: Difference intervention vs. comparison slopes (β_5)	0.99 (0.98–1.01)	1.00 (0.98–1.01)	1.00 (0.99–1.02)	1.00 (0.99–1.02)
Immediate post: Diff. intervention vs. comparison levels (β_6)	1.11 (0.78–1.59)	1.13 (0.83–1.54)	1.14 (0.80–1.61)	1.14 (0.85–1.53)
D-in-D intervention and comparison slopes, post vs. pre (β_7)	1.01 (0.98–1.04)	1.01 (0.98–1.04)	1.00 (0.97–1.02)	1.00 (0.98–1.02)
Calendar month (Ref=January)				
February		0.98 (0.89–1.07)		0.98 (0.85–1.14)
March		1.02 (0.94–1.11)		1.11 (0.98–1.25)
April		0.92 (0.83–1.01)		0.97 (0.86–1.09)
May		0.95 (0.87–1.04)		0.99 (0.83–1.18)
June		0.92 (0.85–1.00)		0.94 (0.85–1.05)
July		0.84 (0.75–0.93) ***		1.00 (0.88–1.13)
August		0.90 (0.81–0.99) *		0.99 (0.89–1.10)
September		0.93 (0.83–1.05)		1.10 (1.03–1.18) **
October		0.92 (0.82–1.04)		0.99 (0.91–1.09)
November		0.87 (0.79–0.96) **		1.06 (0.94–1.18)
December		1.02 (0.93–1.11)		1.11 (1.02–1.22)
Clinic Type (Ref=Dispensary)		1.91 (1.27–2.88) **		1.44 (0.74–2.81)
Ownership Type (Ref=Government)		1.23 (0.88–1.72)		0.96 (0.66–1.39)
Availability of HIV CTC services (Ref=No)		1.50 (1.04–2.17) *		1.55 (0.78–3.09)
Total number of CHWs		0.99 (0.83–1.17)		1.07 (1.02–1.13) *
Estimated within facility autocorrelation†	0.81	0.64	0.75	0.59

Significant at: *p <0.05; **p <0.01; ***p <0.001; aIRR, adjusted incidence rate ratio; CI, confidence interval; D-in-D: difference in difference; †AR1 correlation structure

Table 5. Hospital model: Single group interrupted time series estimates, by district, unadjusted and adjusted for seasonality.

Facility Deliveries	**District 1: Iringa Rural**		**District 2: Kilolo**	
Interrupted Time Series Parameters	**IRR (95% CI)**	**aIRR (95% CI)**	**IRR (95% CI)**	**aIRR (95% CI)**
Intercept (β_0)	195.2 (177.0–215.2) ***	200.5 (178.9–224.7) ***	165.7 (155.2–176.8) ***	156.9 (144.4–170.5) ***
Pre-intervention trend (β_1)	1.00 (0.99–1.00)	0.99 (0.986–0.997) **	1.00 (0.99–1.01)	1.00 (0.99–1.00)
Difference in level, immediate post (β_2)	1.15 (0.98–1.36)	1.36 (1.19–1.55) ***	1.03 (0.93–1.13)	1.03 (0.97–1.10)
Difference in slope, post-pre (β_3)	1.01 (0.99–1.03)	1.00 (0.99–1.01)	1.01 (1.01–1.02) **	1.02 (1.01–1.02) ***
Calendar month (Ref=January)				
February		1.01 (0.87–1.17)		0.94 (0.84–1.06)
March		1.11 (0.96–1.28)		1.11 (1.01–1.22) *
April		1.06 (0.92–1.22)		1.08 (0.98–1.19)
May		1.05 (0.91–1.22)		1.11 (1.01–1.22) *
June		1.09 (0.94–1.26)		1.02 (0.92–1.12)
July		1.04 (0.90–1.21)		1.03 (0.93–1.14)
August		1.29 (1.12–1.49) ***		1.10 (1.00–1.22) *
September		1.10 (0.94–1.28)		1.11 (1.01–1.23) *
October		1.29 (1.11–1.50) ***		1.06 (0.96–1.17)
November		1.27 (1.09–1.48) **		0.99 (0.90–1.09)
December		1.11 (0.95–1.28)		1.04 (0.93–1.16)
Estimated within facility autocorrelation†	0.03	-0.09	-0.12	-0.30

Significant at: *p <0.05; **p <0.01; ***p <0.001
aIRR, adjusted incidence rate ratio; CI, confidence interval
†AR1 correlation structure

Table 6. Mean total facility deliveries per month (all facilities, district-wide) and proportion of hospital deliveries out of total facility deliveries per month, during the pre-intervention and intervention periods, stratified by district.

District (includes all facilities)	Pre-Intervention Mean (95% CI)	Intervention Mean (95% CI)	Difference Mean (95% CI)	Relative Change
Facility Deliveries (n)				
District 1: Iringa Rural	687.6 (685.9, 689.3)	694.2 (691.9, 696.5)	6.6 (3.8, 9.5) ***	0.95%
District 2: Kilolo	496.6 (494.8, 498.4)	502.9 (500.9, 504.8)	6.3 (3.7, 8.9) ***	1.27%
Hospital Deliveries (proportion)				
District 1: Iringa Rural	0.29 (0.28, 0.31)	0.34 (0.32, 0.35)	0.043 (0.023, 0.063) ***	17.2%
District 2: Kilolo	0.34 (0.32, 0.35)	0.39 (0.37, 0.41)	0.049 (0.027, 0.072) ***	14.7%

Significant at: *p <0.05; **p <0.01; ***p <0.001
CI, confidence interval

Table 7. Total annual facility deliveries and hospital deliveries by district for 2014-2016, with year-on-year percent change.

District (includes all facilities)	Iringa	Kilolo
Facility Deliveries	**n (year-on-year % change)**	
2014	7,726	5,881
2015	8,083 (+4.6%)	5,993 (+1.9%)
2016	8,166 (+1.0%)	6,002 (+0.2%)
Hospital Deliveries		
2014	2,339	2,014
2015	2,344 (+0.2%)	2,076 (+3.8)
2016	2,805 (+19.7%)	2,417 (+16.4%)

Chapter 4 *"Because even the person living with HIV/AIDS might need to make babies"* – Perspectives on drivers of feasibility, acceptance, and adoption within an integrated community health worker program in Iringa, Tanzania.

Abstract

Background

Community health workers (CHWs) form an important link between primary health care facilities and communities, but are often vertically oriented around a single disease, such as HIV. In resource-constrained countries with health workforce shortages, there is renewed interest in developing multipurpose CHWs who can deliver integrated services. In two districts of Iringa, Tanzania, an existing cadre of HIV-focused CHWs was trained on maternal, newborn, and child health (MNCH) promotion, provided additional supervision support, and required to report MNCH data. To evaluate how the combined HIV/MNCH CHW model was viewed by key participants, a qualitative study was undertaken to gain insight into the feasibility, acceptability, and adoption of the integrated model.

Methods

Using a case study design, qualitative in-depth interviews with 36 CHWs, 21 supervisors, and 10 program managers were conducted following integration of HIV and MNCH responsibilities. Thematic analysis explored participant perspectives, focusing on task planning, prioritization and integration, workload across HIV and MNCH tasks, and program feasibility, acceptance, and adoption. Interview data and field observations were also used to describe implementation differences between HIV and MNCH roles as a basis for further contextualizing the qualitative findings.

Results

Diverse perspectives suggested that provision of both HIV and MNCH health promotion by volunteer CHWs was feasible. However, implementation was only "partially" integrated at the community level, with systems of supervision, data reporting and management remaining separate by design. CHWs carried out HIV and MNCH responsibilities on separate days, so tasks remained siloed, rather than integrated, despite recognition that some clients required both services. Most CHWs attempted to

balance HIV and MNCH responsibilities. However, some prioritized MNCH responsibilities for a variety of reasons, such as increased community recognition and/or the perceived urgency and importance of the work. The increased workload from MNCH did not appear to interfere with HIV responsibilities, but did draw time away from other income generating activities. Satisfaction with the combined HIV-MNCH role hinged on increased community respect, gaining new knowledge and skills, and improving health of the community. However, there was widespread dissatisfaction that the additional MNCH workload was not coupled with a commensurate monthly stipend increase; a complaint and program design flaw that could challenge sustainability and wider adoption efforts.

Conclusion

The integration of HIV and MNCH services at the community level is a relatively new area of research. This study demonstrated that a volunteer CHW can feasibly balance the two different roles of providing HIV and MNCH services in households, but not without some challenges related to the heavier workload. High program acceptance was documented early in implementation. Further research is needed to determine the quality of this health promotion in both HIV and MNCH domains, and whether the integrated model can be maintained over time.

Keywords: Community Health Worker, HIV, Implementation Research, Integration, Maternal Child Health Services, Qualitative, Tanzania

Introduction

Maternal, newborn, and child health (MNCH) services, sexual and reproductive health services (SRH) and HIV programs are often organized and delivered vertically in Sub-Saharan Africa (Rabkin *et al.*, 2009; Hope *et al.*, 2014). However, integration of MNCH, family planning, and nutrition, with HIV services is well recognized as an important strategy for reducing maternal and child mortality, and the Global Plan for Elimination of Mother-to-Child-Transmission of HIV calls for "leveraging synergies, linkages, and integration for improved sustainability" (Lindegren *et al.*, 2012). Numerous definitions of *integration* have been put forth; a definition that explicitly considers health systems functions is "a variety of managerial or operational changes to health systems to bring together inputs, delivery, management, and organization of a particular service functions" (Adams *et al.*, 2003; Hope *et al.*, 2014). Service integration is generally thought of in the context of facility-based care, rather than within community settings. Findings from a recent systematic review of the evidence for integration of HIV, MNCH, family planning, and nutrition suggested sufficient evidence that HIV/AIDS integration with MNCH/family planning/nutrition was feasible to implement across a variety of contexts, and that many studies documented improvements in health coverage and outcomes (Lindegren *et al.*, 2012). However, the paucity of evidence for HIV and MNCH service integration at the community level was notable from the review: Among the 20 studies identified, only one was based at the community level (Creanga *et al.*, 2007). Given the numerous health issues facing women and children, a model for community-based integration is also needed.

By supporting health promotion at the individual and community level and through linking health facilities and communities, community health workers (CHWs) serve an important primary health care role. A growing body of evidence suggests that CHW programs can improve child nutrition, reduce maternal and neonatal mortality, increase family planning access, and contribute to the control of HIV, tuberculosis, and malaria (Lewin *et al.*, 2010; Perry *et al.*, 2014). Most CHWs provide services within homes, villages, and community gatherings, rather than in formal health facility settings but there is widespread variation in CHW program implementation models (Perry and Crigler, 2014). Central to policy debates is whether CHWs should provide services in only one health

care area (the "vertical" or specialist approach) or integrate services in multiple areas (the "horizontal" or generalist approach)?

Previous findings have shown that integrated services are generally favored due to reduced fragmentation of services, improved care outcomes, and increased patient satisfaction (Shigayeva *et al.*, 2010). Calls for "people-centered" health systems also support integration efforts that consider people's needs in design and delivery of services (Sheikh *et al.*, 2014). At health facilities, service integration is also thought to improve human resource efficiency, provided existing staff can absorb additional activities (Sweeney *et al.*, 2014). Developing multiple vertically-oriented CHW cadres could be cost and resource prohibitive, when one multipurpose CHW could suffice. However, there may be tradeoffs with the number of tasks a CHW can effectively perform before quality and productivity begin to decline from work overload. At present, there is limited evidence on the ability of volunteer CHWs to effectively absorb additional tasks.

Design factors that influence CHW performance have been widely examined. Higher CHW performance was associated with greater perceived responsibilities, longer service delivery times, and more weekly time spent on the job, with more responsibility for curative tasks bringing self-reported motivation and increased community recognition (Kok *et al.*, 2015). Studies in several countries have assessed the effect of expansion of CHW duties. In Rwanda, adding provision of family planning to the existing responsibilities of a nationally supported volunteer CHW program did not significantly change time spent on service provision or travel, and nearly all CHWs reported workload manageability and high job satisfaction (Chin-Quee *et al.*, 2016). In Bangladesh, adding treatment for severe acute malnutrition to the workload of CHWs focused on case management of acute respiratory infection and diarrhea led CHWs to work significantly more hours per week, while maintaining quality of care for both preventive and curative tasks (Puett *et al.*, 2012). In Malawi, a qualitative study identified challenges to integrated responsibilities for CHWs: task overloading (CHWs unable to fulfill multiple roles); task specialization (over-emphasis on newly learned skills); and difficulty managing competing disease priorities (multiple programs and stakeholders) (Smith *et al.*, 2014).

In Tanzania, the health care system is supported by an extensive network of roughly 41,000

CHWs in mainly volunteer single disease programs, nearly half centered on either HIV or maternal, newborn, and child health (MNCH) (MUHAS and JHSPH, 2015). The lack of coordination and harmonization across these numerous CHW cadres, supported and operated by various implementing partners and non-governmental organizations, has prompted Tanzania to begin establishing a multipurpose, national cadre of CHWs. Since 2013, a National CHW Task Force and the CHW Learning Agenda Project[3] have been supporting the government on the implementation of the new CHW cadre by drafting the CHW policy guidelines (2014) and CHW training curriculum (2015). In November 2016, 3,737 students formed the first cohort of graduates from the 9-month national CHW training program. Unfortunately, a hiring freeze has delayed deployment (AAPH and MUHAS, 2017).

To support Tanzania's development and rollout of an integrated CHW cadre, this study documents a program innovation to integrate HIV and MNCH at the community level and qualitatively explores *how* CHWs manage the combined HIV and MNCH responsibilities and *why* it worked (or not).

Methods

Program Context

The program is based in Iringa Region located in the Southern Highlands Zone, 500 kilometers (KM) southwest of Tanzania's largest city, Dar es Salaam. Coverage estimates for MNCH indicators were higher in Iringa Region than nationally in the 2010 and 2015 Demographic and Health Surveys. However, the prevalence of HIV in Iringa Region (9.1%) ranks second highest in the country at nearly double the national average (5.1%) (Tanzania NBS and ICF Macro, 2011; Tanzania Commission for AIDS *et al.*, 2013; Tanzania MoHCDGEC *et al.*, 2016). For 10 years, an implementing partner (Deloitte) has supported local civil society organizations in managing over 400 volunteer CHWs providing home-based HIV services in four districts. Previously, CHWs had received 12 days of training to provide home-based HIV support services. These CHWs live and work

[3] CHW Learning Agenda Project (CHW LAP) is the overarching research collaboration between Muhimbili University of Health and Allied Sciences (MUHAS) and Johns Hopkins University. This case study was embedded within CHW LAP.

at the village level, serving as the main link between the health system and community. Most villages in Iringa are supported by one or two HIV-focused volunteer CHWs, each following 15 to 100 households. Typical tasks include tracking HIV clients who miss appointments, nutrition counseling, providing psychosocial support to clients and family members, promoting treatment adherence, and educating clients on available income generating opportunities.

In recent years, the community HIV workload of CHWs has been reduced as antiretroviral drugs became more available and the number of extremely sick HIV/AIDS patients decreased. This led implementing partner administrators to suggest that HIV-focused CHWs could absorb additional duties involving maternal and child health care, instead of appointing a new cadre of volunteers which would have been more expensive. Their goal was to increase antenatal care (ANC) utilization and facility deliveries. Therefore, during 2015 they trained roughly half of the CHWs for three weeks using the MNCH curriculum approved by Tanzania's Ministry of Health. These "dual role" CHWs were tasked with both HIV and MNCH services (compared to "single role" CHWs focused on HIV).

The implementing partner selected CHWs for MNCH training, without explicit criteria or involvement from the managing local civil society organizations. MNCH training was conducted separately for the two districts, being held in June 2015 (Kilolo) and November 2015 (Iringa Rural). It consisted of two weeks of classroom and one week of practicum sessions. The MNCH curriculum covered a variety of health promotion topics, organized around the timing of home visits during the antenatal, postpartum, and early childhood periods (Table 1). These included: antenatal care booking, pregnancy danger signs, nutrition, birth preparedness, breastfeeding, malaria prevention, HIV/AIDS, PMTCT, gender issues, family planning, newborn care, newborn danger signs, infection prevention, and postpartum care and changes in the mother. CHWs were instructed on recommended frequency and timing of MNCH visits, including at least three antenatal home visits, seven postpartum and infant health home visits, and quarterly child health home visits until five years of age (Table 1).

A facility-based HIV health care worker provided HIV-focused supervision to both single and dual role CHWs. However, dual role CHWs also reported to a second facility-based health care worker for MNCH-related supervision. "Focal persons" from the civil society organization also

provided monthly HIV-focused supervision to CHWs. Modest monthly stipends were provided to CHWs, which increased from the initial $17 to $20 USD for all CHWs following MNCH training, regardless of single or dual responsibilities.

Sampling

Among the four districts in Iringa Region where the program was implemented, two were excluded due to the following reasons: Mufindi had another ongoing initiative, the Partnership for HIV-Free Survival, which may have shifted toward prevention of mother-to-child HIV transmission; and Iringa Municipal is predominantly urban, and hence less informative for the national development of a rural-based, integrated CHW cadre. In Iringa Rural and Kilolo, six types of respondents involved in implementation of the program were selected for interviews using several sampling approaches (Table 2). At the implementing partner's regional office, the director, HIV technical officer, and reproductive and child health technical officer were interviewed. At the civil society organization in each district, all staff members with program responsibilities were interviewed, including the director, project coordinators, and "focal persons" (CHW supervisors).

CHWs and their supervisors were interviewed from 20 facilities (10 per district) among the 71 facilities involved across the two districts. Purposive sampling methods were used to achieve maximum variation in facility and CHW characteristics, including:

- Facility type (dispensary or health center, district hospitals excluded)
- Facility ownership (government or faith-based)
- Facility location within the district
- Availability of HIV Care and Treatment Center (CTC) services
- Average monthly service utilization in 2015 (1st ANC visits, facility deliveries)
- Facilities where *all* or *none* of CHWs had additional MNCH training
- Number of CHWs reporting to dispensary or health center (range: 1 to 11)
- Type of CHW (single or dual role)
- Sex of CHW

The locations of sampled dispensaries and health centers are presented in Figure 1. Roughly half of Iringa Rural falls within Ruaha National Park to the West, while the Udzungwa Mountains National Park covers the Eastern edge of Kilolo. This geography explains the clustering of health facilities closer to the center of each district.

Data Collection

Semi-structured in-depth interviews (IDIs), 30-60 minutes long, were conducted in Swahili by six Tanzanian research assistants with prior qualitative research experience, who had been trained in the study specific methods in January 2016. The English and Swahili versions of the IDI guides were reviewed after pretesting to ensure understanding of the purpose of each question and that the Swahili translation was accurate (Appendix 1). The research team organized the open-ended questions in the IDI guides by several themes, identified *a priori*, including:

- Training and guidance for integration of HIV and MNCH tasks.
- CHW role expansion from HIV to MNCH.
- CHW performance.
- Workload balance (HIV and MNCH tasks).
- Feasibility, acceptance, and adoption of integrated model.
- Recommendations for program improvement.

Interviews were conducted over three weeks during February 2016, which was early in the implementation phase: three and eight months after MNCH training in Iringa Rural and Kilolo, respectively. The civil society organizations convened regularly scheduled monthly meetings with CHWs at central locations to share information, discuss challenges, collect monthly HIV summary reports, and assess data quality. Due to logistical considerations by the civil society organizations, one meeting was held in Iringa Rural and five meetings in Kilolo. Where possible, the study team held interviews with CHWs to coincide with these monthly meetings. Visits to selected facilities were scheduled to interview supervisors and CHWs not been reached during the monthly meetings.

Every day following data collection, the study team debriefed on the content of the IDIs, monitored data collection progress, and reviewed plans for subsequent data collection events. A standard form was used to document team debrief notes, including completion of planned interviews, main points by respondents, and emergent ideas and themes. Research assistants also submitted a form with summary notes on each IDI, including interview setting and quality, key summary points, and any new information.

Data Management and Analysis

During February and March 2016, the audio-recorded interviews were transcribed by six

research assistants, three of whom had conducted the IDIs. Personal identifiers were removed from transcripts to ensure confidentiality. To assess transcription quality, a Tanzanian research scientist listened to audio-recorded interviews while reading along with the transcript for two files per transcriptionist. From April to June 2016, the interviews were translated from Swahili into English by seven professional translators. The research scientist at MUHAS reviewed quality of translation for the first and seventh documents submitted by each translator, reading each Swahili paragraph followed by the English translation for the full document.

Qualitative data management, coding, and thematic analysis were performed using the web-based software, Dedoose (SocioCultural Research Consultants, 2016). Familiarization with field notes and interview transcripts supported the initial preliminary coding structure, based on presumptive topics in the interview guides and emerging themes identified during the familiarization phase. The structure of the preliminary codebook was independently tested by two primary coders: a female American public health doctoral candidate from JHSPH, who was experienced in qualitative research and served as study co-investigator responsible for developing interview guides and the preliminary codebook; and a male Ghanaian undergraduate public health student at Johns Hopkins University, who previously served as a CHW in Ghana and was familiar with concepts discussed in the IDIs. Each coder deductively applied codes from the preliminary codebook to two selected transcripts. They met to compare code agreement, examining line-by-line for discrepancies. Through this process, the coders reached consensus, discussed modifications and code definitions, and agreed on the definition of newly emergent codes. Four additional transcripts were independently coded and compared to assess agreement. Codes were further refined and added or deleted as new themes become apparent (Zhang and Wildermuth, 2005). The final codebook contained 68 codes within six thematic areas (Appendix 2). Remaining transcripts of IDIs were divided between the two primary coders.

A subset of codes was used to explore factors that enabled or challenged attempts at integrating HIV and MNCH by volunteer CHWs (Table 4). Specifically, we sought to examine three implementation outcomes – feasibility, acceptability, and adoptability – which are best suited to the introduction of novel interventions and can be assessed early in the implementation stage (Proctor *et*

al., 2011). These outcomes are defined as (Peters *et al.*, 2013):

- **Feasibility**: "the extent to which an intervention can be carried out in a particular setting or organization" – also referred to as practicality, actual fit, utility, or suitability for everyday use.
- **Acceptance**: "the perception among stakeholders that an intervention is agreeable" – also referred to as acceptability, comfort, relative advantage, or credibility.
- **Adoption**: "the intention, initial decision, or action to try to employ a new intervention" – also referred to as uptake, utilization, or intention to try.

Our analysis relied primarily on application of deductive codes related to the primary research question, with synthesis of key findings using a thematic analysis approach. Code reports were exported from Dedoose for further analysis. Data display matrices were created to chart key findings and illustrative quotes by IDI respondent type, including concise, descriptive, text-based summaries for each key finding. Data matrices helped identify recurrent patterns and facilitated comparison of diverse perspectives from all categories of respondents. Key findings are presented in the context of understanding program feasibility, acceptance, and adoption. Additionally, interview data and field observations were used to compare implementation features of the HIV and MNCH roles.

Ethical Considerations

The study was jointly approved for ethical clearance by the Institutional Review Boards of JHSPH in Baltimore, Maryland (IRB No. 00005497) and MUHAS in Dar es Salaam, Tanzania (Ref. No. 2015-12-18/AEC/Vol. X/94). All potential study participants underwent a verbal informed consent process in Swahili using an IRB-approved consent form, with documentation of consent by the research staff.

Results

Sample Characteristics

A total of 67 IDIs were conducted with six types of respondents: 21 dual role CHWs, 15 single role CHWs, 10 HIV supervisors, 11 MNCH supervisors, 7 program management staff from civil society organizations, and 3 technical staff from the implementing partner (Table 2). CHWs and facility-based supervisors were drawn from 20 facilities (10 per district), including 15 dispensaries and 5 health centers (Figure 1; Table 3). Most facilities were government-owned and roughly half

provided HIV care and treatment (CTC) services. The median distance to the nearest hospital was 41 KM (IQR: 20–65). Seven facilities were supported by single role CHWs, 12 facilities by dual role CHWs, and 1 facility was a "combination" site to which one single and one dual role CHW both reported. Service load in almost all sampled facilities averaged less than 10 first ANC visits and less than 10 facility deliveries per month, per 2015 routine health information system data.

The 36 CHWs sampled for IDIs represented approximately 20% of CHWs (N=187). The demographic characteristics of this subset of CHWs were similar to the results presented previously for the full sample (Manuscript 1). The average age of CHWs was 42.9 years old (±6.6 SD), median duration of previous community health experience was 8.7 years (±2.8 SD), with an average of 5.6 dependents (±1.9 SD). Half of CHWs were female (53%), and the majority were married (78%) with a primary school (Standard 7) education (97%). About 20% of CHWs reported a monthly income less than $25 USD, meaning their income was almost entirely supported by the monthly volunteer stipend.[4] All CHWs (100%) reported agricultural farming and most also reported (86%) livestock farming as a source of additional income. The median distance between a CHW's home and supervisory health facility was 2 KM (IQR: 1–5). Most CHWs (72%) reported walking to household visits and 33% reported travel time to the supervisory facility of more than one hour. CHWs were primarily linked to dispensaries (81%) for supervision and data reporting.

HIV and MNCH Implementation: Key Differences

Program implementation varied with HIV and MNCH tasks (Table 5). Interview respondents commonly referred to HIV-focused CHWs as "HBCs" or "home-based care" providers, a volunteer cadre officially recognized by the Government of Tanzania to provide HIV support services. HBCs who received additional MNCH training were commonly called "WAJAs" or "Wawezeshaji wa Afya ya Jamii" in Swahili, which translates to "community health agents". This naming distinction was notable in that it implied MNCH-focused tasks were synonymous with "community health" tasks, and perhaps commanded broader community merit and recognition.

[4] For context, the gross national income of $920 USD in 2015 equates to a monthly income of $77, but in rural areas of the country this value is likely much lower (The World Bank, 2016).

The longstanding home-based care HIV program dates back to 2006 in Iringa, whereas the MNCH role introduced in this project began in mid-2015, bringing new health education topics to the community. The catchment area for dual role CHWs remained the same, but specific target populations differed. HIV tasks focus on HIV-positive individuals linked to CHWs for continuous village/community-based support, whereas MNCH tasks are delivered to all pregnant and postpartum women and children under-5 years old identified through a village census conducted by CHWs. There is some overlap between target populations, as pregnant and postpartum women should receive education on both HIV and MNCH topics, in addition to HIV-positive clients (women, partners, and children) who need care.

Both HIV and MNCH roles emphasize prevention, with client interaction centering on health education and promotion, and CHWs helping to mobilize health facility visits. HIV lessons can be tailored to general HIV prevention education messaging or individual client needs, often dependent on health status, duration of the disease, and past care. Sometimes, CHWs may conduct group sessions for HIV clients, in lieu of individual household visits. In contrast, MNCH lessons vary with the timing of household visits and tend to require more time to cover more topics involving pregnancy, newborns, and other children in the household. Of note, household visits conducted by single role CHWs risk stigma if community members suspect a household member is HIV-positive. In contrast, visits by dual role CHWs provoke less stigma, with unknown services being provided.

Supervision and management systems for the integrated model were kept largely separated by HIV and MNCH domains, with rather infrequent intersection between facility supervisors, civil society organizations, and the implementing partner. The data reporting flow and supervision processes are depicted in Figure 2. By program design, dual role CHWs report to both HIV and MNCH supervisors, usually located at the same facility. Infrequently, dual role CHWs report to HIV and MNCH supervisors at separate facilities. At some facilities, the MNCH-focused supervisor provides support on both HIV and MNCH tasks, a scenario observed at about 25% of facilities sampled for dual role CHW IDIs (Table 3). A focal person from the civil society organization also provides supervisory support to CHWs for HIV-related tasks. Reporting and data monitoring also

remain separate by program design. All CHWs submit a monthly HIV summary report to their facility-based HIV supervisor, with a copy also to their civil society organization focal person. Additionally, dual role CHWs submit a monthly MNCH summary report to their facility-based MNCH supervisor, but ***not*** to the civil society organization. The separate MNCH reporting mechanism was viewed as problematic by the civil society organizations, since it left them without quantitative data on MNCH program progress.

Feasibility: Role Expansion and Workload

Perspectives on CHW role expansion were assessed to understand task planning, prioritization, integration strategies, and choices made by dual role CHWs in carrying out their volunteer HIV and MNCH duties. The relationship between the additional MNCH workload and HIV role maintenance was also considered.

Task Planning

Dual role CHWs frequently mentioned the importance of "timetables" in planning their schedules to ensure both HIV and MNCH tasks were effectively managed. Discussions around timetables revealed that most respondents were not conceptualizing a fully "integrated" program. CHWs often scheduled HIV and MNCH home visits on different days of the week, as illustrated by this respondent:

> *I am supposed to have three timetables: one for my own activities, the other one for MNCH activities, and one for HBC activities… So, I do my own work up to 12, because you can't find anybody at home in the morning especially during this rainy season, so when I have an appointment with someone it has to be around 3 PM, and that is why I set my timetable that way. After coming back from the field, I get myself prepared and then I visit someone at a particular place. I use Monday, Tuesday and Wednesday for HIV victims and Thursday, Friday and Saturday for MNCH. But as I said earlier sometimes it happens that a person needs all the services depending on their situation.*
> *(Dual Role CHW, Male, Dispensary #8, Kilolo)*

There were several commonly cited reasons for scheduling HIV and MNCH tasks on separate days, particularly that MNCH clients require a specific visit schedule, in contrast to HIV clients. MNCH visits also may require a flexible schedule responsive to changing health needs of the mother. For example:

> *For the pregnant mothers, I am supposed to visit them when they have three months, eight months, and then after giving birth. But it depends, because sometimes there are emergencies, that means I can visit her any time. For instance, the day before yesterday she was sick, then I have to visit her today to see how she is doing on where she was referred, maybe she was either successful or not… but for the case of HIV infected people, I visit them at least twice a month on a proper schedule. There is timetable for visiting pregnant mothers and infant children in order to know their development and give them advice.*
> *(Dual Role CHW, Female, Health Center #3, Iringa Rural)*

During MNCH training, dual role CHWs were instructed to plan for HIV and MNCH activities on separate days for operational reasons: Carrying both HIV and MNCH registers is burdensome and lesson plans and educational messaging are different for the two services. For example:

> *When you serve people in the community, you need to sort your patients into categories... We discouraged them to provide both HIV/AIDS and MNCH services concurrently because it would be impossible for the same HBC to carry and correctly fill out the registers for HIV/AIDS patients and for MNCH services. Because of that insistence, we believe that our HBCs are well prepared for the job and we hope that they are doing their best to balance between the two services as it is insisted in the new HBC curriculum because it highly discourages providing the two services concurrently on the same day. We discourage them to do so because there are those who can handle the two services well and those who cannot afford to mix the two services at once. (Director, Female, Regional Implementing Partner)*

Some respondents suggested it was more efficient to plan HIV and MNCH services on separate days, but recognized there were scenarios where a client required both services. For example:

> *Yes, in order to be able to work efficiently the [HIV and MNCH] days should be different. Unless when the same patient falls into both categories. For example, when the pregnant mother is also HIV positive. So, here you kill two birds with one stone.*
> *(Dual Role CHW, Male, Dispensary #9, Kilolo)*

Task Prioritization

Interviews explored whether dual role CHWs attempted to balance HIV and MNCH components, or whether they prioritized one of the services. Some facility supervisors felt that CHWs balanced the tasks well, and about half of dual role CHWs stated there was equal weighting of the two tasks. It was recognized that both HIV and MNCH services were critical to the community's health, and neither could be neglected, as described by the following passages:

> *It's very challenging but we have to manage both of them because you can't take care of one client and leave another. All are human beings. So, as a health worker, you have to take care of them. That's why we have a schedule which guides us when we should visit which clients and provide health care to them. (Dual Role CHW, Female, Dispensary #4, Kilolo)*

> *I think both services are given the same emphasis because if we ignore any of these services you will see them hanging and we will end up with an increasing number of deaths in the community. The HBCs prioritize both HIV/AIDS and MNCH services. There is nothing that is left behind! (MNCH Supervisor, Female, Dispensary #9, Kilolo)*

Despite the equal emphasis given by several, many dual role CHW respondents prioritized MNCH for several reasons. The urgency of need appeared to influence how dual role CHWs thought about HIV and MNCH household visits, with MNCH clients often perceived to have more urgent acute complications. The increased availability of antiretroviral treatment, ensuring better health outcomes for HIV patients, has progressively shaped views of HIV as a chronic health condition. Therefore, the stage of the HIV epidemic may have contributed to CHW perceptions that HIV patients required less urgent care. Additional reasons to prioritize MNCH included the impact on two lives (mother/child) and the perception that pregnant and postpartum women needed more education. For example:

> *You know, this is about human's life and they are two of them. So, when I get informed about a pregnant woman with some problems I often run to help them because they are two and in that situation, they are in danger. But an HIV patient's problems are mainly opportunistic infections, or sometimes they feel bad and when I visit them we just talk about what to do and it is over. But when you find a pregnant mother has certain bad signs she must get help as quickly as possible. I can just say that if both a pregnant mother and an HIV victim come to me for help, I will help the pregnant mother first.*
> *(Dual Role CHW, Male, Dispensary #7, Kilolo)*

> *A pregnant woman carries two lives: that is hers and her babies. Also, there are some complications which they may face which can lead to loss of their lives, and therefore, they need to be followed up closely. Also, there are several deaths of infants especially to those women who deliver at home when they are cutting the umbilical cord. Therefore, we must make a follow up to see if a child was brought to the hospital after delivery so that she can get the services required to the infants. This makes us give priority to maternal and child health services because by so doing we are saving the lives of mothers and children; however, the HBC services are still there but maternal and child health services have to get priority. (HIV Supervisor, Female, Health Center #5, Iringa Rural)*

There was some indication that dual role CHWs considered HIV tasks as "common" or "routine", whereas MNCH tasks were "novel", another possible driver of prioritization decisions:

> *I always begin with MNCH because I am already used to providing HBC services, so they are simple activities to me currently. (Dual Role CHW, Female, Dispensary #15, Iringa Rural)*

In addition, staff at the civil society organization recognized that task prioritization could be problematic:

It can reach a point when HBCs would find themselves focusing on one aspect of the services over the other while he or she is supposed to provide both services. This can be a challenge because prioritizing one side of the service may lead the other segment to slow down. (Focal Person, Female, Civil Society Organization, Iringa Rural)

Task Integration

Despite the emphasis on planning for HIV and MNCH lessons on different days, dual role CHWs recognized there were opportunities for combining services, particularly for pregnant and postpartum mothers at risk of HIV infection or HIV-positive women who want to become pregnant, were currently pregnant, or had children under age five.

In most cases, the number of these households is in both sides because you can find the mother with HIV infection is the one has given birth or is the one pregnant. So, you can find yourself performing two activities at the same place, even for the community health servants you can find AIDS and breastfeeding issues, so they are intermingling. The mother with HIV infections can have a child under the age of five or may be pregnant. (Dual Role CHW, Female, Health Center #1, Kilolo)

The existing ties between CHWs and people living with HIV made CHWs well-placed to deliver the additional MNCH services as a familiar and trusted provider, as illustrated by this quote:

There are benefits because as I said when we combined HBC and CHW I know that that patient is HIV positive. It would be different if you appoint a new person to be a community health worker because s/he doesn't know if a certain patient is living with HIV. Therefore, it becomes difficult to approach and talk to that patient because s/he doesn't know the other side. But for me because she is my client and I know she is HIV positive it becomes much easy for me to tell her direct that because you are HIV positive and now you are pregnant, you have to do one, two, three things, yes. (Dual Role CHW, Male, Dispensary #9, Kilolo)

Supervisors highlighted the benefits of task integration for identifying additional HIV or MNCH clients. Dual role CHWs were also uniquely placed to follow-up with families to urge repeat confirmatory HIV testing for exposed infants. For example:

The HBC could be visiting the infected mother at home only basing on AIDS issues but unfortunately the mother can be having an infant child or under-five child or maybe she can be pregnant. So, for now if she goes to educate the mother on AIDS issues if she finds her pregnant she will advise her about attending clinic sessions, she will advise her on the place to deliver the baby. Those are the successes I see for this HBCs after combining the two services. (MNCH Supervisor, Female, Dispensary #14, Iringa Rural)

When it comes to combining the two services it takes us to issues of PMTCT. It concerns pregnant women, breastfeeding women and exposed babies as the primary target of the HIV/AIDS services. At the same time these categories are also targeted by the CHW-MNCH services. One of the challenges we were facing is that when we administer the DBS [dried blood spot] for HIV test on children and the results come negative most women would not return their children for subsequent testing to confirm the status after weaning approximately

a year and six weeks old. But currently the CHWs have managed to bring back about a quarter of those children. That situation gives us hope because all those children were required to return for testing and they are now back because of the efforts of the CHWs. (RCH Technical Advisor, Female, Regional Implementing Partner)

Workload and HIV Role Maintenance

Geographic catchment areas did not change after HIV and MNCH integration, but the number of target households increased because most homes have children under-five years. Many respondents discussed this issue in terms of workload. The MNCH service:

> *...Requires them [dual role CHWs] to visit every house to determine who is a child and who is not and to know which household has an infant child, which household has a pregnant woman or which household has a problem.*
> *(MNCH Supervisor, Female, Dispensary #9, Kilolo)*

Program leadership recognized the extra MNCH workload and provided guidance on coverage size to ensure quality:

> *The volunteer cannot manage to visit all the clients in two or three villages. So, we told them to have a small coverage area…It is much better for the volunteer to visit twenty women and effectively provide services to them than visit a hundred women once in six months. Therefore, we decided to tell them to concentrate their attention in the areas where the volunteers are from. (RCH Technical Advisor, Female, Regional Implementing Partner)*

Nearly all respondents discussed the added workload of MNCH, but believed HIV responsibilities had not been adversely affected. Dual role CHWs explained that HIV household visits required less time due to improvements in health status and shifting many lessons to group support meetings. These findings may be associated with the stage of the HIV epidemic in Iringa and the overall long-term experience of CHWs in providing HIV home-based care:

> *What helps me now is that at the inception of the HBC service most of the HIV victims were bedridden but after the provision of services and education, and due to the patients' readiness to follow the directives, their health has become stable. This makes it possible for me because instead of going to visit them in their households we now meet during group activities and I tell them what I have instead of meeting them individually. In case one of them does not attend the group meetings because they are ill, I have to visit them at their places." (Dual Role CHW, Male, Dispensary #8, Kilolo)*

Dual role CHWs explained they were able to maintain their original HIV task responsibilities, but this came at a cost in reduced personal time:

> *I use much of my time volunteering. So, you decrease your income because sometimes you use the time that you were supposed to go to cultivate in the evening for visiting your clients to*

provide services. Sometimes you spend the whole day visiting patients because the village is large and there are different places to visit. (Dual Role CHW, Male, Dispensary #9, Kilolo)

The implementing partner also expressed concern that the extra burden of MNCH workload could reduce time for personal responsibilities and other income generating activities:

> *Giving the HBC too many responsibilities will make them not to have enough time to take care of their other activities…we do not want to take too much time from them because at the end of the day HBCs are not salaried, they only receive a stipend.*
> *(Director, Female, Regional Implementing Partner)*

Similarly, some staff from the civil society organizations expressed concern with the added MNCH workload, suggesting CHWs were not able to handle existing HIV responsibilities:

> *When I look even at the normal HBC activities of caring for people with HIV/AIDS I can see that they are already overwhelmed, and when you add other responsibilities may be only those who can really work hard will be able to handle it. But with added responsibilities most HBCs are really struggling as you have witnessed yesterday that some HBCs had not completed the tasks. So, although they say they like the job, maybe they like it because of the money they get through attending seminars and workshops, but when it comes to performance they get really tired and overwhelmed.*
> *(Program Manager, Female, Civil Society Organization, Kilolo)*

Acceptability and Adoption of Integrated HIV-MNCH Model

CHW Satisfaction with Expanded Role

Many dual role CHWs drew work satisfaction through their new ability to help improve maternal and child health in their community, in addition to their longstanding HIV role. For example:

> *The HBCs themselves were impressed with the program because they witnessed firsthand the incidents that occurred in their villages before they were trained. Despite the incidents, the HBCs could not be of help before the training and as a result the people had to continue seeking assistance from Traditional Birth Attendants. But after the training the HBCs are happy because they have become useful to the society now that they can help their fellow community members. (Focal Person, Male, Civil Society Organization, Iringa Rural)*

> *Firstly, we were doing work we could see the problems facing pregnant women but we could not be able to do anything though our intention was one [to help women]. We were dealing with AIDS only and the other problems we could see them but we could not tackle them but now after being trained it has been easy for us to help people.*
> *(Dual Role CHW, Male, Dispensary #7, Kilolo)*

The additional MNCH responsibilities were also associated with increased community recognition and a sense of feeling valued, for example:

> *My experience has improved; first I have become known to many, and also, they have recognized me as a health leader in the ward. (Dual Role CHW, Male, Dispensary #6, Kilolo)*

Education and acquisition of new skills was also acknowledged as an advantage of the integrated model, both personally and for the community:

> *One of the advantages is the provision of education. You can also receive some education that will help your family. It's one of the benefits in your own family: You receive this education and you will also provide the education to your children and grandchildren. It's a benefit. Educating the community is a huge benefit because you can save the lives of people from unnecessary deaths. (Single Role CHW, Male, Dispensary #1, Kilolo)*

> *Most HBCs take the added responsibility as an opportunity to expand their knowledge and scope. Also, they enjoy the fact that their community acceptance has increased now that they are no longer seen as people providing exclusive HIV/AIDS care alone.*
> *(Director, Female, Regional Implementing Partner)*

Some CHWs also spoke of their duty or obligation to perform the extra MNCH responsibilities because they had been selected or nominated for that purpose:

> *To some extent this is a volunteering work and remember the community has appointed you. Therefore, you are supposed to work for the community and as a volunteer. So, you work by remembering that the community has trusted you.*
> *(Dual Role CHW, Female, Health Center #3, Iringa Rural)*

While the contribution to society was a major driver of work satisfaction, respondents also mentioned the issue of increased workload coupled with a low stipend as demotivating:

> *The HBCs have received it very positively. Yet, they complain that the workload is too big and they find it hard to handle both responsibilities. Despite the work overload that they complain about, they provide the required services very well in caring for people living with HIV/AIDS as well as MNCH. The HBCs complain that the work is too demanding resulting in not meeting their family and household obligations.*
> *(MNCH Supervisor, Female, Dispensary #4, Kilolo)*

Some CHWs expressed dissatisfaction with the dual role, primarily linked to the stipend issue. There was an expectation that an increase in workload and responsibilities should be accompanied by a commensurate increase in monthly stipend. The modest monthly stipend increase from 35,000 to 40,000 Tanzanian Shillings (from ~$17 to $20 USD) was for *all* CHWs, irrespective of single or dual role status. As one CHW described it, they received a monthly stipend for their HIV role, but the MNCH role was perceived as completely voluntary since it came with no additional stipend:

> *I am satisfied though we gain nothing even a soap, in the first job we are given Tshs 35,000/= after a couple of months but this job we just only volunteer. We are satisfied and at the beginning we were told it is volunteering job, so we are just working with the hope that they will think of us. Unfortunately, as time goes on there is nothing new, so we just know it is volunteering job. (Dual Role CHW, Female, Dispensary #5, Kilolo)*

Supervisors and civil society organization staff reiterated a need for increased incentives to improve program acceptance:

> *Honestly, the ones I heard were complaining about a huge workload and low pay. They complained that they had a huge workload, and we then asked them what if we increased their remuneration, and they replied, yes, that would help them find alternative ways such as find help to compensate for their other income generating activities like farm work they forsake when concentrating their HBC engagements.*
> *(Program Manager, Female, Civil Society Organization, Kilolo)*

As evidence of program acceptance, the implementing partner reiterated that dual role CHWs were performing both duties, collecting data, and submitting reports:

> *They bring us reports, and that means they do the job, something which also means they accept the program. Although they complain that the responsibilities have increased, they still support the program by providing the services, bringing reports and collecting data. Therefore, I can say that they really support the program and they see it as useful in expanding the availability of health care services to more communities. The HBCs have gained skills and they are happy about it.*
> *(HIV Technical Officer, Female, Regional Implementing Partner)*

One Role vs. Two Roles for Volunteer CHWs

Respondents were asked about whether CHWs in this program should have one or two roles. Many dual role CHWs were happy with their combined HIV and MNCH responsibilities, but some CHWs preferred to have only one role. The nuanced views among CHWs currently tasked with both HIV and MNCH responsibilities is highlighted in the following excerpts:

> *It will be better if the two programs are together because we are living in a world of infections. A large part of the community is infected and people live with HIV and the same people are the parents; therefore, it is not a sin to combine the two programs, it is a good thing. However, as I said earlier, if it is the same person who is going to work in the two programs, s/he should be taken care of so as to perform better.*
> *(Dual Role CHW, Male, Dispensary #9, Kilolo)*

> *I prefer AIDS…Because I am used to this work and I have been doing it for quite some time now and people know me as a home-based care health service provider.*
> *(Dual Role CHW, Female, Health Center #5, Iringa Rural)*

> *If I was given a chance to decide today I would choose to remain as a community health worker, only that. You know, in the past HIV was something strange but now we are educated or our HIV clients are educated in that even in the household, the family or the society in general if there is a problem they advise one another to go for HIV test in time but the maternal, infant and children health care is new and that is why if I am to decide I would like to serve women and children in order to reduce deaths of women and children through education. People are steeped in HIV education in that it has become something normal.*
> *(Dual Role CHW, Male, Dispensary #7, Kilolo)*

Single role CHWs were eager to receive the training on MNCH, with some stating their communities were disadvantaged by not yet having a CHW trained on MNCH. They believed they had sufficient time to handle the second role because the health of their HIV patients had largely stabilized, although they acknowledged the extra MNCH workload could be challenging and they expressed uncertainty about the time commitment.

Facility supervisors were mixed in their opinions about whether the HIV and MNCH roles should be integrated by CHWs. Some cited benefits to patients of providing both services together, but challenged the efficiency of balancing two responsibilities. Other program managers differed in their views of integration. Staff from the civil society organizations primarily thought HIV and MNCH roles should remain separate, whereas staff at the implementing partner supported integration:

> *The combined services should be separated so as to increase efficiency because most HBCs are primary school leavers and they have other work to do, including farm work, to raise their income, they generally have so much in their hands. Although they really like to be trained and be able to provide both HIV/AIDS and MNCH services, but they are really occupied. Considering their level of education, honestly speaking, and the nature and amount of paperwork they have to work on, we really have to work hard and often give them the chance to update their skills through refresher training courses or something like that. Therefore, I generally think that the services need to be separated so as to achieve better results. (Program Manager, Female, Civil Society Organization, Kilolo)*

> *I was suggesting that the program be maintained the way it is without splitting the services. Because if we have two people providing two different services to the same recipient there would be unavoidable conflicts…So, I think that the same volunteer can act both as CHW and an HBC and be able to follow up on the patients. The volunteers only need to be provided with tools for them to do the job because that is one of the major challenges. (HIV Technical Officer, Female, Regional Implementing Partner)*

Program Adoption: Should the Integrated Model be Expanded?

To assess perspectives on adoption, respondents were asked whether the integrated model should be expanded throughout Iringa Region. CHWs overwhelmingly agreed the remaining single role CHWs should also receive MNCH training, for several key reasons:

- Long term experience in providing HIV services has made CHWs known to their communities as trusted providers.
- Issues of equity across villages, as women in all villages need MNCH services, but there are not enough dual role CHWs for adequate coverage.
- Advantages to offering HIV and MNCH services together, such as identifying HIV-positive clients.

However, some CHWs recognized that the integrated model might not be appropriate for all:

> *The way I perform my duties can be different from the way others do. I mean that the combination of the services could be a burden to some of us, that they may be unable to perform well all the duties as they are required. So, I think that those who are ready and able to carry out all the duties should be the ones to be involved though it would be better if all the health workers are involved. (Dual Role CHW, Male, Dispensary #8, Kilolo)*

Other supervisors overwhelmingly believed the remaining HBCs should receive MNCH training. They spoke of the important role of CHWs as a link between the community and the facility, and how they could help identify pregnancy and complications sooner. In addition, supervisors cited fairness and equity as a reason to extend MNCH training to the remaining single role CHWs:

> *If there will be uniformity among us, then we will do a better job. Because we are serving the same client, therefore we should have the same information and not different and that will enable the job to be done effectively. (HIV Supervisor, Female, Dispensary #5, Kilolo)*

If the program would be expanded, there were also calls for increased stipends commensurate with the extra MNCH workload:

> *I think if that happens [expansion of MNCH training] each health worker will carry out both roles but their income has to be improved first. That means it will be their job. They will not think of going to farm first at work hours and later go to visit patients. Also, if we divide them into two groups; HBC and MNCH it will not be a better way of using resources. We could have one person performing both roles effectively and this will be more helpful. (MNCH Supervisor, Female, Dispensary #15, Iringa Rural)*

Staff from the civil society organizations were less supportive of extending MNCH training to all single role CHWs. Several respondents suggested that single role CHWs wanted to attend MNCH training only to receive per diems or an expected stipend increase in the future, not because they were interested in delivering additional MNCH responsibilities.

> *So, I discovered [laughter] that all they want is money because when they attend training they are given per diem for each day. Although they want to undergo the MNCH training, they know the challenges awaiting them in providing the MNCH health care services. I told them that their colleagues were saying that MNCH is way too challenging and they were requesting a pay raise but the still demanded that they go for that training because they do not know how provide those services. So, I sensed something there.*
> *(Program Manager, Female, Civil Society Organization, Kilolo)*

However, CHW responses generally indicated interest and commitment to MNCH beyond the potential for remuneration.

Discussion

This case study describes program modifications to an established HIV-focused volunteer

CHW program to include MNCH responsibilities. IDIs with a broad range of program implementers helped identify factors that either enabled or challenged integration efforts. CHW satisfaction and workload balance ultimately were linked to feasibility, acceptance and adoption of the integrated model (Figure 3). Sources of satisfaction with dual responsibilities included new education, increased community respect, and improved MNCH outcomes, whereas dissatisfaction stemmed from the heavier workload with only a minimal stipend increase. These results are consistent with a recent qualitative evidence synthesis of implementation barriers and facilitators of lay health worker programs to improve MNCH access, which found key motivating factors to be altruism, social, recognition, and increased knowledge (Glenton *et al.*, 2013). Most CHWs attempted to balance HIV and MNCH responsibilities. However, some CHWs prioritized MNCH responsibilities, citing increased community recognition and perceived importance of the work. Workload balance also sometimes shifted toward MNCH responsibilities due to lengthier household visits and the urgency of MNCH conditions, in contrast to the stabilization of HIV needs in the community.

Several findings suggest the program was only "partially" integrated. Most notably, dual role CHWs carried out HIV and MNCH responsibilities on separate days, so that tasks remained siloed, rather than integrated. If clients required both HIV and MNCH services, some CHWs reported providing both services during a single household visit. The observation that most CHWs delivered HIV and MNCH education on separate days is likely attributable to the planning guidance received during MNCH training. In addition, the HIV and MNCH domains remained separate as far as systems of supervision, data reporting, and management. Interviews revealed a complex system that included different lines of data reporting for HIV and MNCH services, separate facility-based supervisors for HIV and MNCH, and support from the civil society organizations that was mostly HIV-focused (Figure 2). These findings are important for future program designs to integrate services at the community level.

Realistic workloads are needed to prevent CHW burnout and sustain motivation. This study found similar challenges to those identified in Malawi among CHWs with expanded roles: newly learned skills were often over-emphasized and task overloading could result in CHWs being unable to

fill multiple roles (Smith *et al.*, 2014). Studies examining extra time requirements for additional CHW tasks have had mixed results. In Bangladesh, CHWs spent significantly more hours per week volunteering when their workload expanded to include treatment of severe acute malnutrition (Puett *et al.*, 2012). In Rwanda, adding family planning to existing CHW responsibilities did not significantly change reported time spent on service provision or travel (Chin-Quee *et al.*, 2016). This study did not quantitatively measure CHW time spent volunteering, but dual role CHWs qualitatively described spending two to three additional days per week volunteering for MNCH responsibilities, on top of their HIV responsibilities. This was consistent with a recent survey in Morogoro, Tanzania which found volunteer MNCH-focused CHWs averaging 2.9 work days per week and 4.8 hours per day (LeFevre *et al.*, 2015).

When CHWs are responsible for more activities, role overload becomes a key risk due to the increased time and effort by volunteers (Schneider *et al.*, 2016). In this study, the joint provision of both HIV and MNCH tasks by volunteer CHWs was feasible and generally well accepted in rural Tanzania, although challenged by workload and remuneration. The increased MNCH workload did not appear to interfere with HIV responsibilities, but drew time away from other income generating activities. This was similar to CHW time allocation documented in Burkina Faso, Nigeria, and Uganda, where personal time and time spent on agriculture decreased when rapid malaria testing and treatment were added to CHWs tasks (Castellani *et al.*, 2016). In this study, the most common recommendation was to increase the monthly stipend commensurate with added time requirements for MNCH responsibilities. Dissatisfaction with stipend levels was widespread and could challenge acceptance, adoption, and sustainability of the integrated model. However, non-financial incentives are also important for motivation and should be considered in future program adjustments and policies.

Ensuring Rigor

Steps to ensure research rigor (trustworthiness) were taken throughout the study design, data collection, and analytical phases (Gilson *et al.*, 2011). To improve credibility, research team debrief meetings after each data collection event discussed interview findings and recurrent and emergent

themes. Research assistants documented interview impressions with contact sheet memos to describe settings, quality, and new or surprising perspectives. The iterative process of team debriefing helped reveal our own research biases evident in how questions were formulated and asked, and suggested additional probes and question modification helpful for going forward. The research team spent 6 weeks in the Iringa Region during February and July 2016 for qualitative and quantitative data collection, collaborating closely with the civil society organizations which helped facilitate the data collection. Credibility was improved by the prolonged experience of MUHAS colleagues in researching CHW programs in Tanzania and the research team's ongoing engagement with the civil society organizations and implementing partner beyond the period of data collection.

In the analysis phase, systematic comprehensive reviews of transcripts, along with peer debriefing between coders, helped improve data credibility (Creswell, 2006). One primary coder provided an external check on data interpretation, having not been involved in study design or data collection. He also brought a unique perspective, having formerly served as a CHW in Ghana. A strength of this study was its multiple perspectives from IDI respondents involved in all aspects of the integrated HIV-MNCH model in two districts, each supported by a different civil society organization. Data matrices were used to triangulate responses across respondent types, which helped confirm findings. Research on lay health worker programs could benefit through inclusion of perceptions from a wider stakeholder group, including program planners and managers (Glenton *et al.*, 2013). This study includes multiple perspectives from the civil society organizations and the implementing partner to help capture a more complete picture of the integrated CHW model from the viewpoint of managers and technical staff.

To improve dependability and confirmability, an audit trail documented all study procedures thoroughly and transparently, including decisions related to sampling, recruitment, data collection, and analysis (Houghton *et al.*, 2013). Through careful documentation of the implementation context, transferability of study findings to other volunteer CHW programs looking to expand roles and responsibilities was improved. In Tanzania, where roughly half of all volunteer CHW programs are either HIV or MNCH-focused, this study is highly relevant to ongoing implementation decisions,

supporting HIV-MNCH integration at the community level.

Study Limitations

Despite the multiple perspectives presented by respondents involved in implementation, interviews with community members would have provided further important perspectives on program acceptance and experiences with dual role CHWs. Observation of household visits also would have contributed understanding of *how* dual role CHWs performed their integrated duties and contributed to measures of implementation fidelity.

IDIs were conducted relatively early during the implementation phase, so that findings do not reflect long term perceptions of the integrated model or later stage implementation outcomes such as penetration and sustainability. A further limitation is the potential for respondent bias, particularly among CHWs who may have felt compelled to answer favorably, and program managers who shared opinions they though researchers wanted to hear. The reliability and validity of participant responses can be difficult to verify, as respondents may express support for a position or policy, but may actually act in ways that undermine successful implementation (Varvasovszky and Brugha, 2000). Respondent bias in this study was minimized through training research assistants to remain neutral, practicing rapport building skills during mock interviews, and reiterating confidentiality. Research assistants were instructed to emphasize that responses would help the government develop stronger community health systems, but that this research had no bearing on continued funding of the integrated HIV-MNCH model in Iringa.

Conclusion

The intersection of HIV and MNCH service is critical in communities with elevated HIV prevalence and high maternal and child morbidity and mortality, "*Because even the person living with HIV/AIDS might need to make babies*" (Focal Person, Female, Civil Society Organization, Kilolo). Findings from this study offer a nuanced portrait of the experience of volunteer CHWs and program managers regarding role expansion from HIV to MNCH. This study demonstrated that a volunteer CHW can feasibly balance the two different roles of providing HIV and MNCH services in

community households, but not without some challenges related to the heavier workload. High program acceptance was found in its early implementation. Further research is needed to determine the quality of this health promotion in both HIV and MNCH domains, and whether the integrated model can be maintained over time.

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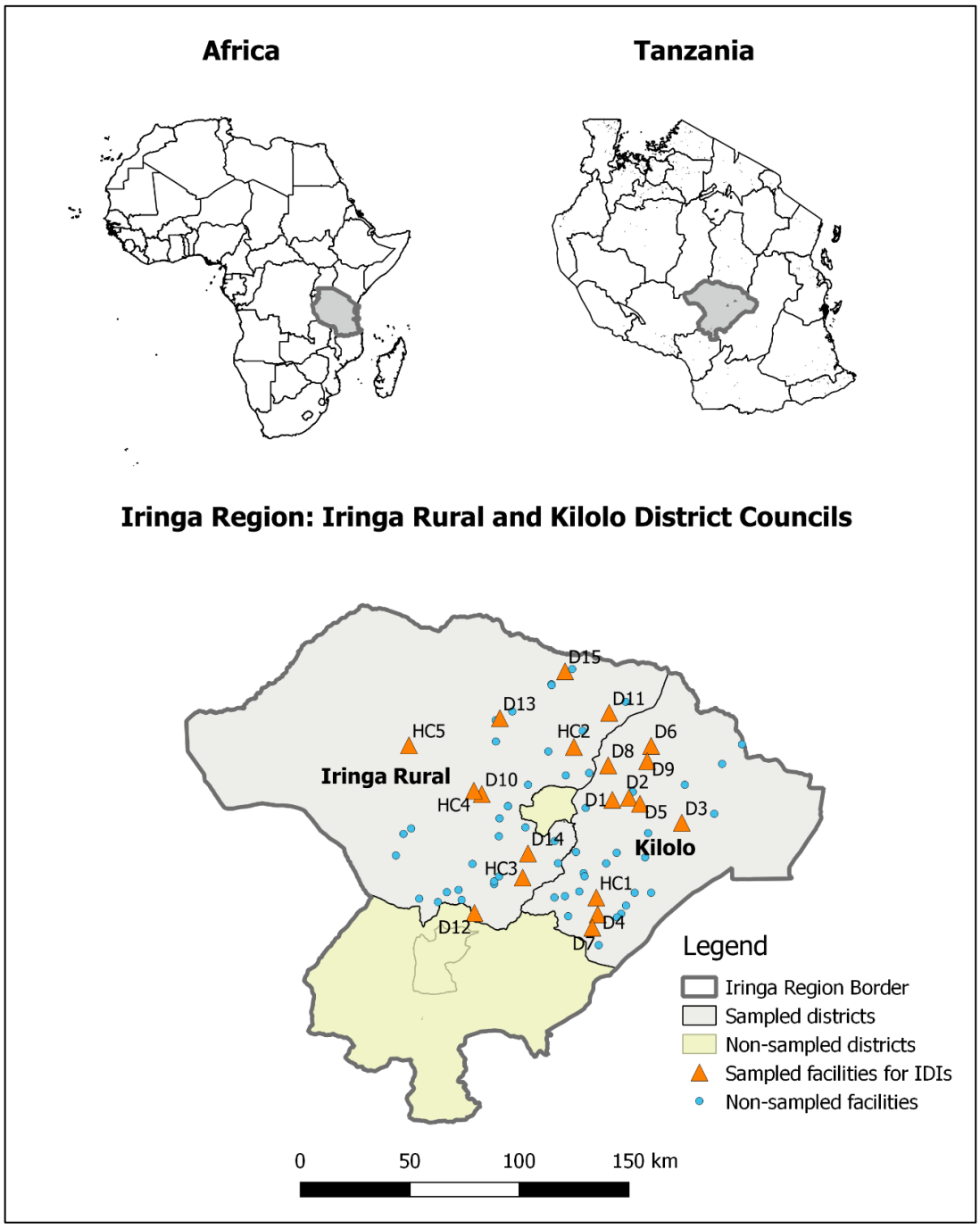
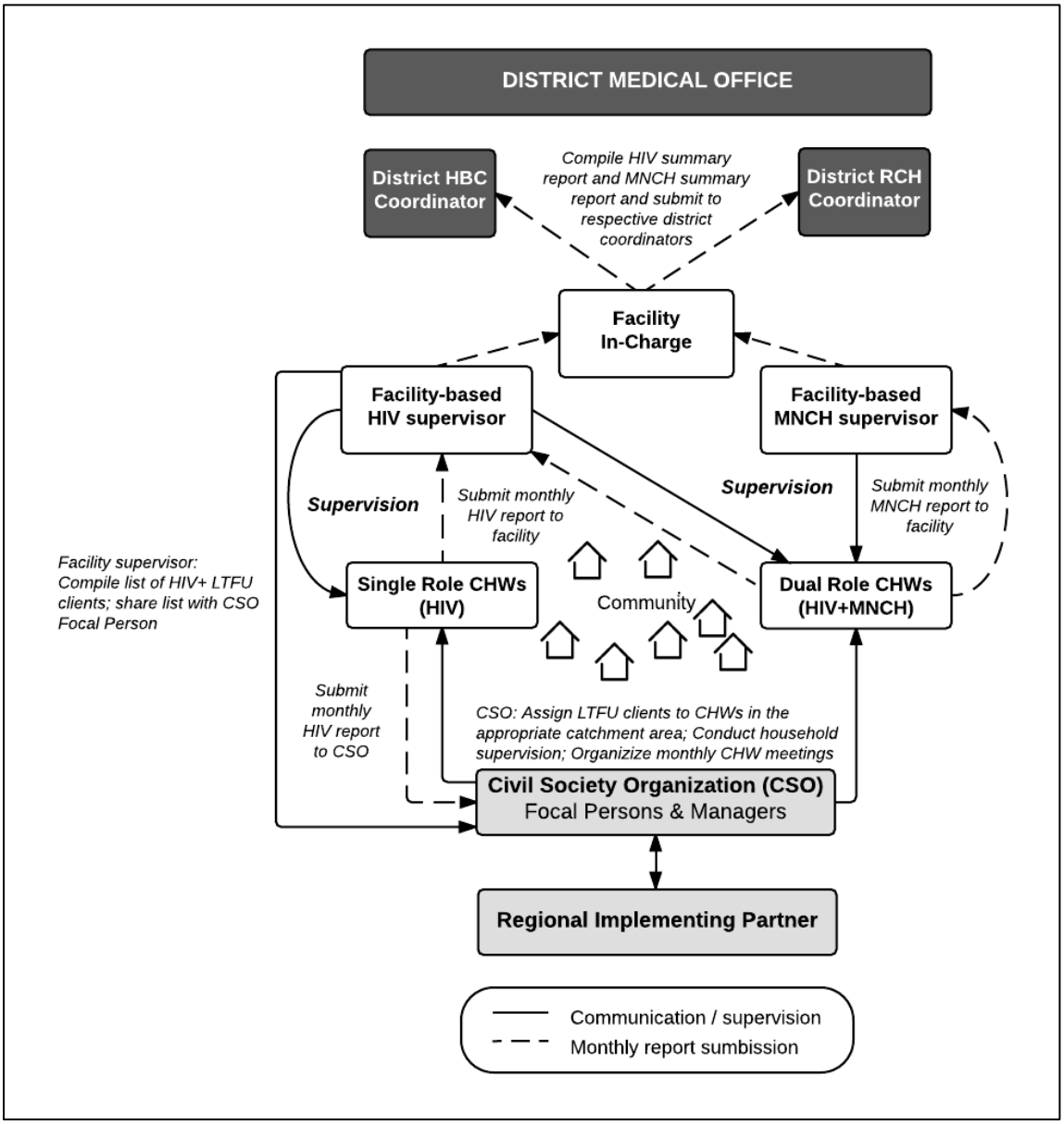
Figures and Tables

Figure 1. Map of Africa, with location of Iringa Region in Southwestern Tanzania, and location of the 20 sampled facilities in Iringa Rural and Kilolo District Councils.



Notes: Dispensaries: D1 to D15; Health Centers: HC1 to HC5
Maps were generated using QGIS Version 2.18 (QGIS Development Team, 2017). Country, regional and district boundaries were sourced from Tanzania's National Bureau of Statistics (Tanzania National Bureau of Statistics, 2013b). Coordinates for health facilities were sourced from an online health facility registry maintained by Tanzania's Ministry of Health (Tanzania MoHSW, 2015b).

Figure 2. Relationship between the implementing partner, civil society organization, CHWs, and health facility staff for data reporting flow and supervision.



CSO, civil society organization; HBC, home-based care; LTFU, lost to follow-up; RCH, reproductive and child health

Figure 3. Drivers of feasibility, acceptance, and adoption of HIV-MNCH integrated model.

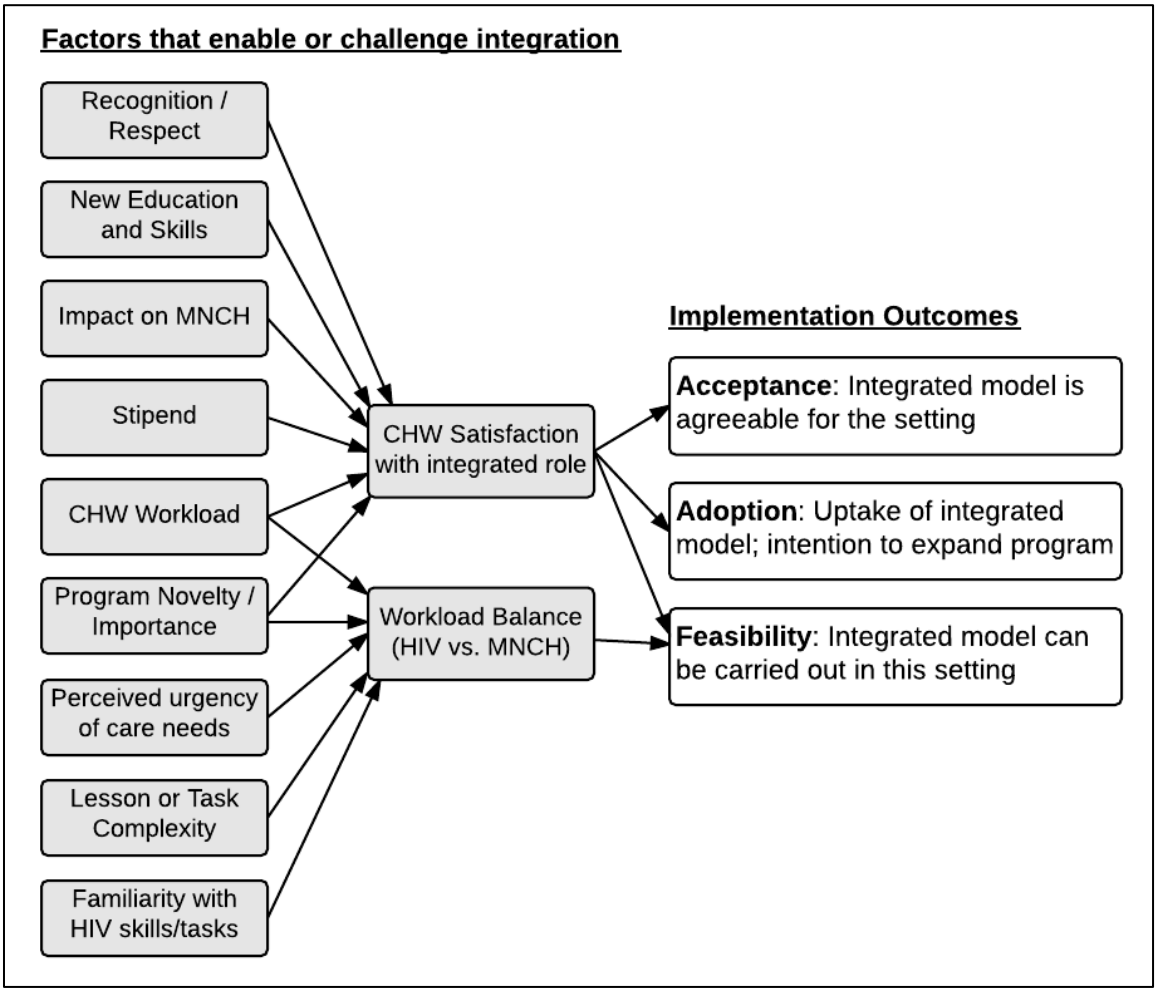


Table 1. Schedule of home visits for community-delivered MNCH.

ANTENATAL VISITS	
First home visit	As early as CHW identifies pregnant woman
Second home visit	At six months of pregnancy
Third home visit	At eight months of pregnancy
POSTPARTUM MATERNAL AND NEWBORN/INFANT HEALTH VISITS	
First home visit	Within 24 hours of delivery, after discharge from the health facility
Second home visit	Third day after delivery or discharge from the health facility
Third home visit	Eighth day after delivery or discharge from the health facility
Fourth home visit	Third week after delivery
Fifth home visit	Fifth week after delivery
Sixth home visit	Third month after delivery
Seventh home visit	Fifth month after delivery
CHILD FOLLOW-UP VISITS	
Follow-up home visits	Once every three months, up to five years of age

(Reproduced from Tanzania MoHSW, 2012).

Table 2. Summary of total IDIs conducted and sampling approach for each respondent group.

Group	Respondent Type	IDIs	Sampling Approach
CHWs	Single Role CHWs	15	CHWs linked to purposively sampled
	Dual Role CHWs	21	facilities for maximum variation
Supervisors	HIV supervisors at facility	10	Supervisors from purposively sampled
	MNCH supervisors at facility	11	facilities for maximum variation
Managers	Civil Society Organization Staff	7	"Focal persons", program managers,
	Implementing Partner Staff	3	and/or technical staff
	Total Interviews	**67**	

Table 3. Summary of facility, CHW and supervisor characteristics among respondents interviewed at each sampled facility, by district.

Facility		HIV	Referral	Utilization / Mo. ϕ		CHW IDIs	CHW Sex		Facility-based Supervisor IDIs: Qualifications	
ID	**Owner**	**Services†**	**Distance‡**	**ANC1**	**Delivery**	**Type (Total IDIs)**	**#M**	**#F**	**HIV Supervisor**	**MNCH Supervisor***
Iringa Rural Summary			**Avg=52**	**Avg=9.2**	**Avg=9.7**	**9 Single; 8 Dual**	**6M**	**11F**	**5 HIV supervisors**	**5 MNCH supervisors**
D10	Public	RCH	40 km	4.2	2.8	Single (2)	1M	1F	Medical Attendant	*Not Applicable*
D11	FBO	RCH	65 km	5.1	5.3	Single (2)	1M	1F	Medical Attendant	*Not Applicable*
D12	Public	CTC/RCH	49 km	6.0	8.9	Single (3)	2M	1F	*Unavailable*	*Not Applicable*
D13	FBO	RCH	67 km	16.1	4.1	Dual (1)	—	1F	*None*	Nurse Midwife
D14	Public	RCH	15 km	6.9	7.7	Dual (2)	1M	1F	*None*	Enrolled Nurse*
D15	Public	RCH	92 km	12.2	12.9	Dual (2)	—	2F	Medical Attendant	Enrolled Nurse
HC2	Public	CTC/RCH	41 km	12.7	25.5	Single (1)	—	1F	*Unavailable*	*Not Applicable*
HC3	Public	CTC/RCH	34 km	11.3	10.6	Dual (1) Single (1)	1M	1F	Registered Nurse	Registered Nurse
HC4	Public	CTC/RCH	47 km	9.8	8.8	Dual (1)	—	1F	*Not interviewed*	*Not interviewed*
HC5	Public	CTC/RCH	72 km	8.0	10.7	Dual (1)	—	1F	Midwife	Registered Nurse
Kilolo Summary			**Avg=32**	**Avg=9.0**	**Avg=9.3**	**6 Single; 13 Dual**	**11M**	**8F**	**5 HIV supervisors**	**6 MNCH supervisors**
D1	Public	RCH	10 km	4.1	4.0	Single (3)	2M	1F	Clinical Attendant	*Not Applicable*
D2	FBO	RCH	1 km	26.0	12.5	Single (1)	—	1F	*Unavailable*	*Not Applicable*
D3	Public	RCH	41 km	7.1	5.8	Single (2)	1M	1F	Enrolled Nurse	*Not Applicable*
D4	Public	RCH	65 km	5.4	5.3	Dual (2)	1M	1F	*None*	Medical Attendant
D5	Public	RCH	10 km	8.2	8.4	Dual (1)	—	1F	Enrolled Nurse	Clinical Officer
D6	Public	RCH	26 km	2.8	1.2	Dual (1)	1M	—	Medical Attendant	*None*
D7	Public	CTC/RCH	75 km	6.2	6.7	Dual (3)	3M	—	*Unavailable*	Midwife
D8	FBO	CTC/RCH	21 km	7.5	12.3	Dual (2)	1M	1F	*None*	Enrolled Nurse*
D9	Public	CTC/RCH	19 km	17.9	24.1	Dual (2)	1M	1F	*None*	Registered Nurse*
HC1	Public	CTC/RCH	55 km	4.8	12.6	Dual (2)	1M	1F	Medical Attendant	Enrolled Nurse
Combined Summary			**Avg=42**	**Avg=9.1**	**Avg=9.5**	**15 Single; 21 Dual**	**17M**	**19F**	**10 HIV supervisors**	**11 MNCH supervisors**

Abbreviations: D=Dispensary; HC=Health Center; km=kilometers; M=Male; F=Female; FBO=Faith Based Organization

† HIV Care Services: CTC=Care & Treatment (adult & pediatric); RCH=Reproductive & Child Health (PMTCT, often including Option B+)

‡ Referral distance is the number of kilometers to the nearest hospital (either the district hospital or regional referral hospital) and is an indication of the remoteness of the facility

ϕ Service utilization is the average monthly number of 1st ANC visits and average monthly number of facility deliveries from Tanzania's 2015 DHIS2

Not Applicable indicates there was no MNCH supervisor because the facility does not have any dual role CHWs

Unavailable indicates the interview could not be scheduled (i.e. the supervisor was travelling off-site or on-leave)

None indicates the facility had no staff trained to provide CHWs with either HIV or MNCH-specific supervision

*In some cases, the MNCH supervisor provided CHWs with supervision for both HIV and MNCH (the case for 3 of the 11 MNCH supervisors interviewed)

Not interviewed indicates the HC4 facility was not visited for HIV and MNCH supervisor interviews; instead, the IDI with the dual role CHW occurred at the nearby D10 facility

Table 4. Selected codes used in analysis of feasibility, acceptance, or adoption of the integrated HIV-MNCH model.

Themes	Sub-Themes	Codes
Feasibility	Role Expansion	Task Planning Task Balance vs. Prioritization Task Integration
	Workload	Catchment Change Workload Time HIV Role Maintenance Integration Challenges
Acceptability / Adoption	Acceptability of Integrated Model	CHW Satisfaction with Expanded Role One Role vs. Two Roles for CHWs Advantages / Disadvantages for CHWs Acceptability: By Supervisors By Civil Society Organizations By Implementing Partner
	Adoption of Integrated Model	Scale-up of Integrated Model across Iringa Implementation Recommendations

Table 5. Comparison of implementation features for HIV and MNCH tasks performed by CHWs.

Feature	HIV-focused tasks	MNCH-focused tasks
Name	HBCs or "Home-based care" providers	WAJAs (*Wawezeshaji wa Afya ya Jamii*) or "community health agents"
Novelty	Longstanding activity in the community	New health education/promotion activity in the community
Target	HIV-positive clients	Pregnant and postpartum women, newborns, and children under-5 years old
Lessons	Individual client needs or group needs	Depending on visit timing (pregnancy vs. postpartum, child's age)
Duration	Shorter visits for routine clients, longer visit for newly identified HIV-positive	Longer visits (up to 1 hour) for mothers and children
Setting	Individual homes or group settings in community	Individual homes
Stigma	Potential stigma with single role CHWs	Reduced stigma with expanded MNCH role (neighbors can't distinguish purpose of visit)
Urgency	Stable/chronic, less urgency	Acute high-risk situations, more urgency
Supervision	Facility-based HIV supervisor	Facility-based MNCH supervisor
Civil Society Organization	"Focal person" from civil society organization provides HIV supervision	No MNCH supervision from civil society organization
Reporting*	HIV monthly report submitted to civil society organization and facility-based HIV supervisor	MNCH monthly report submitted to facility-based MNCH supervisor *only*

*The majority of dual role CHWs submit HIV and MNCH monthly reports to one facility, but roughly 15% submit HIV and MNCH data to separate facilities, meaning their HIV and MNCH supervisors are located at separate facilities

Chapter 5 Conclusion

This study addresses an important debate about whether volunteer CHWs are better suited to single- or multi-task responsibilities, and how many tasks one CHW can perform effectively. During 2015, a long-established HIV-focused CHW program in Iringa, Tanzania, underwent an innovative change, involving approximately half of the volunteer CHWs who received additional training on MNCH, supervision support, and responsibilities for performing and reporting MNCH responsibilities. This setting provided an opportunity to assess the integration of HIV and MNCH tasks at the community level. The following summary includes key findings, program and policy implications, directions for future research, strengths and limitations, and closing thoughts.

Summary of Findings

Examination of an innovative CHW program model, presented in three manuscripts, sought to provide evidence for implementation decisions effecting the rollout of Tanzania's national integrated CHW cadre. The combination of HIV and MNCH tasks delivered by CHWs occurred within a longstanding volunteer CHW program focused only on home-based HIV care. Comparisons between single and dual role CHWs are drawn throughout each manuscript.

Manuscript 1 examined whether HIV-focused CHWs could effectively absorb additional MNCH responsibilities without compromising their HIV workload. The new workload was measured in terms of household visits conducted for HIV or MNCH related tasks, aggregated per CHW per month. A comparative interrupted time series analysis assessed trends in HIV household visits conducted by single versus dual role CHWs, after controlling for secular trends and CHW and facility covariates. The results suggested dual role CHWs appeared able to maintain their HIV client workload while adding MNCH tasks to their routines, albeit with an initial slight interruption to their HIV workload. In Iringa Rural, the interruption to HIV workload appears temporary, whereas in Kilolo a new, slightly lower steady state of HIV workload is reached. These findings offer initial quantitative evidence that HIV-MNCH integration by CHWs is feasible, and suggests there is some spare capacity in vertically-oriented single disease focused programs and that gains can be made through integration.

Manuscript 2 assessed whether community-delivered MNCH health promotion and counseling impacted facility delivery utilization, a proxy for skilled birth attendance. The outcome measure, monthly facility deliveries, was extracted from routine HMIS data from dispensaries, health centers, and hospitals in the catchment areas served by single and dual role CHWs. Longitudinal trends in facility deliveries were assessed using interrupted time series methods and included separate models for the health center/dispensary levels and hospital levels. At health centers and dispensaries, a slight downward trend in facility deliveries was observed, although the change in trend was not statistically significant. At hospitals, a significant increase in the mean number of deliveries per month was evident in both districts during the intervention. District-wide, total facility deliveries were stable over time (~1% increase), but during intervention there was a 15% relative increase in the proportion of hospital deliveries out of total facility deliveries. These findings suggest community-level efforts to counsel women on the importance of facility delivery may be an effective approach to improving utilization of facility delivery services. In addition, the increase in hospital deliveries may be indicative of an increase in bypassaing behavior, whereby women chose to seek childbirth services at the hospital, where quality of care is presumably higher, rather than from their local dispensaries and health centers. Further documentation of facility delivery messaging by dual role CHWs is needed to determine *how* CHW efforts may have contributed to the choice of childbirth facilities. Given the rural context and the already high coverage of facility deliveries, it remains unknown whether dual role CHWs were effective at reaching the so-called last 10% – the pregnant women who would otherwise have otherwise delivered at home.

Manuscript 3 qualitatively explores *how* the CHWs were able to manage additional MNCH responsibilities and *why* it worked (or not). In-depth interviews with CHWs, supervisors, and, program managers shed light on complexities of the integrated CHW model, as well as the drivers of feasibility, acceptability, and adoption. Field observations also documented implementation differences between HIV and MNCH roles. Diverse perspectives suggested that MNCH responsibilities could feasibly be added to the workload of HIV-focused CHWs. The additional MNCH tasks improved CHW satisfaction, giving the volunteers increased community respect, new

education and skills, and fulfilment from helping to further improve health in their communities. However, the extra workload due to MNCH was challenging, particularly in taking time away from other income generating activities. Most dual role CHWs tried to balance HIV and MNCH responsibilities, although they sometimes prioritized MNCH responsibilities, perhaps for prestige (increased community recognition) or the perceived urgency and importance of the MNCH work. This study found that implementation was only "partially" integrated at the community level, since the systems of CHW supervision, reporting, and management remained separate at the higher levels of the health system. Furthermore, CHWs described carrying out HIV and MNCH responsibilities on separate days, meaning that task integration was minimal.

Analytic triangulation was most suitable across Manuscripts 1 and 3, where convergence of results suggests combining HIV and MNCH responsibilities by CHWs was generally feasible and acceptable. Quantitative evidence confirms CHWs were largely able to maintain their HIV workload when MNCH tasks were added, and moreover immediately began performing MNCH responsibilities following training – together pointing to feasibility and acceptability. Qualitative evidence offers implementation perspectives on the factors that supported or inhibited feasibility and acceptance of the integrated CHW model, in particular highlighting program design areas (remuneration, management structures) that require further attention to ensure sustainability.

Policy Implications and Future Research

In line with several other African countries in the region with large-scale national CHW programs – Ethiopia, Malawi, Rwanda, and Zambia – Tanzania has made impressive strides in launching a national integrated CHW cadre. The relevance of this study should be considered in light of important overarching differences between the integrated CHW model evaluated in Iringa and the recently launched national integrated CHW cadre, including: volunteer vs. professionalized status; breadth and scope of responsibilities; implementing partners and civil society organizations vs. district and national health system support; and the division of preventive vs. curative services offered. Nevertheless, the integrated HIV-MNCH CHW model in Iringa can in some ways serve as a microcosm of the national integrated CHW model because it tackles two major program areas: HIV

and MNCH. The following sections address important research findings applicable to community health implementation in Tanzania at this crucial time of rollout of the national CHW cadre.

Compensation: Volunteer vs. Paid CHWs

Tanzania's Ministry of Health is moving beyond CHW volunteerism: Leadership of the Health Promotion Section have stated preference for paid "professional" CHWs. They support the WHO recommendation that "essential health services cannot be provided by people working on a voluntary basis if they are to be sustainable. While volunteers can make a valuable contribution on a short-term or part-time basis, trained health workers who are providing essential health services, including community health workers, should receive adequate wages and/or other appropriate and commensurate incentives" (WHO, 2008; Van Praag, 2017).

The national CHW cadre will be formally incorporated into the health system and on the government payroll, presumably at least at minimum wage level of 310,000 Tanzanian Shillings monthly (~$135 USD). In November 2016, the first cohort of 3,737 students graduated from the national CHW training program, although a government hiring freeze has delayed their deployment. Tanzania's commitment to developing a professional, paid CHW cadre is critical to rollout success.

Single and dual role volunteer CHWs in Iringa received a monthly stipend supported through donor funding. There was only a minimal increase in the stipend after the intervention was introduced, from ~$17 to ~$20 USD. Interviews revealed dissatisfaction that the additional MNCH workload was not accompanied by a more appropriate stipend increase. This suggested that a program design flaw could lessen CHW motivation and performance, and possibly hinder wider adoption efforts of the integrated model. Volunteer CHW programs have been criticized for reliance on unpaid labor, a system which some researchers argue creates an unsustainable program and unintended consequences on local communities (Swidler and Watkins, 2009; Maes, 2010). Many volunteer HIV-care programs in Africa have largely operated under "the assumption that local communities are full of 'untapped' moral and social energy, producing an abundance of individuals ready to donate their labor to make their communities healthier" (Maes, 2010). However, anthropologists and sociologists have begun dismantling "the myth of the selfless volunteer" through documenting lives of volunteer CHWs and

their discontent across various domains, including remuneration (Akintola, 2008; Maes, 2010; Maes *et al.*, 2011). On the other hand, international implementers often argue that volunteer programs *are* sustainable, because local communities can theoretically support them or "take over" after international programs transition out (Maes, 2010). The Iringa case study emphasizes such challenges with volunteerism, international funding cycles, and diverging views on CHW program sustainability. After two five-year funding cycles, the TUNAJALI program in Iringa ended in January 2017. It is unknown whether local civil society organizations can or will continue supporting these single and dual role CHWs. Moreover, it is unclear whether CHWs will continue volunteering without stipends.

Transition: Can (or should) a volunteer CHW sub-system continue in Tanzania?

As the national CHW cadre expands, little has been determined about how the existing volunteer CHWs will be incorporated into Tanzania's health system. No official guidance has been released from the Ministry of Health, although the CHW Task Force is actively discussing transition complexities. In the absence of a clear policy decision, volunteer CHW programs may gradually fade out as implementing partner grant cycles end. However, given the immense size of Tanzania's volunteer CHW workforce, estimated at 40,000, policy options should be considered. Approximately 20% of volunteer CHWs currently meet the educational requirements of secondary education for entry into the national CHW cadre training program (Van Praag, 2017). For the remaining 32,000 volunteers, the Ministry of Health might consider career progression strategies for bringing them into the national CHW training program, especially if they can demonstrate mastery of community health eligibility competencies.

The gradual scale up of the national CHW cadre could take up to a decade, given the limited availability of health training institutions, resource constraints, and training course duration (9 months). Even after fully scaled, the national CHW cadre may not achieve the CHW ratio per population currently covered by the volunteer CHW workforce. Future research and policy discussion are necessary to determine existing CHW volunteers can best continue contributing to the health of their communities. An alternative two-tier CHW framework has been proposed by some community

health experts, with a first tier consisting of a formalized cadre of paid CHWs covering 200-300 households, overseeing a second tier of volunteer CHW "extenders" covering 10-20 households for specific tasks (Perry, 2015). Some aspects of the two-tiered framework are similar to Ethiopia's CHW system, in which professional Health Extension Workers cover a catchment of 3,000-5,000 inhabitants, and train and supervise the Health Development Army of volunteers, each covering 5 households (Teklehaimanot and Teklehaimanot, 2013). Tanzania should draw insight from Ethiopia's two-tiered model, as well as from other countries grappling with the transition away from fragmented, donor-supported volunteer CHW programs. Guidance from the Ministry of Health is necessary to steer donor planning and funding priorities, including financing sources to support volunteer CHWs.

Applicability to Big Results Now and Volunteer CHW Programs

Nearly half of Tanzania's existing volunteer CHW programs are HIV/AIDS or MNCH focused, making the Iringa case study highly relevant to ongoing programs countrywide. Findings may be particularly applicable to the other HIV home-based care volunteer CHW programs in Tanzania, documented at over 7,000 volunteers (MUHAS and JHSPH, 2015). This research explored how volunteer CHWs combined two scopes of work at the household level, and whether increased client load created imbalance in the types of services CHWs prioritized. It also has direct policy relevance to the targeted MNCH training of existing volunteer CHWs in the *Big Results Now* regions of Northwestern Tanzania. The integrated HIV-MNCH cadre appears to have been effective in promoting facility deliveries in Iringa. An interrupted time series analysis using routine HMIS data from the *Big Results Now* regions might confirm the impact of dual role CHWs in a contextually different area with lower HIV prevalence and lower facility delivery coverage. If findings from replication studies show impact, the Ministry of Health might consider an interim strategy of expansion of MNCH cross-training for existing volunteer CHWs. This strategy could help reduce maternal mortality for which progress has been stalled.

Partial Integration

This study examined how CHWs conceptualize their various roles, including the community

respect imparted from those roles. It also shed light on task organization and prioritization in a multi-task environment. Integration is often thought of in terms of service delivery, but other essential mechanisms (supervision, management, and reporting) are required to support integration efforts. The partially integrated nature of this program became evident from observing that the systems of supervision, management, and data reporting remained siloed by HIV and MNCH. Further assessment is needed to determine how the national integrated CHW cadre will function within a PHC system that itself remains siloed by disease area.

Strengths and Limitations

This research should be interpreted in light of several strengths and limitations. It benefited from analysis using multiple methods, including quantitative time trends of data from CHW household registers and facility HMIS records, coupled with in-depth qualitative inquiry. The combination of methods supported analytic triangulation and interpretation of the integrated CHW model, with qualitative data helping contextualize the quantitative findings. Furthermore, the multiphasic data collection allowed for observation and assessment at various stages of the intervention.

For the quantitative analyses, a major strength of this study was its quasi-experimental interrupted time series design, a strong alternative choice when randomization is not feasible due to logistical, ethical, cost, or other issues (Penfold and Zhang, 2013). The design was further strengthened by use of a comparison group, since some CHWs did not receive additional MNCH training. However, there were notable limitations to the outcome measurement. In Manuscript 1, the outcome assessed only that CHWs performed HIV and MNCH household visits, but did not measure the quality of counseling provided to clients or fidelity of intervention delivery. In Manuscript 2, aggregate count data of facility deliveries offered outcome information about service utilization, but not quality of CHW counseling provided to women seeking delivery care. The interrupted time series design attempts to make causal inference about an intervention effect on an outcome of interest. However, it is difficult to determine whether the intervention or some other mechanism was the true cause of the outcome under study. The introduction of the intervention five months apart in Kilolo and

Iringa Rural created a multiple baseline design, which improved confidence that the MNCH intervention was responsible for the observed changes (Biglan *et al.*, 2000).

The reliance on routine HMIS data and CHW household register data, often of poor quality, is another potential limitation. The CHW household visit data were not independently verified between summary forms and source documents, although the civil society organizations and implementing partner conducted routine data quality audits. This study relied on commonly reported HMIS indicators from the labor and delivery reports. Missing data was extremely infrequent. Further data quality validation efforts were not logistically feasible, but would have helped improve confidence in the accuracy of outcome measurements. Despite data quality concerns, the benefits of routine data were considerable, including: numerous repeat observations over extended periods of time; coverage across nearly all facilities; real-time data availability; and multiple indicators of service utilization (Wagenaar *et al.*, 2016).

There was strong comparability between single and dual role CHWs on measured covariates, which helped increase internal validity. However, the higher level of pre-intervention productivity among dual role versus single role CHWs suggested potential selection bias. Also notable was that CHWs affiliated with health centers and hospitals were more likely to receive the additional MNCH training, indicating a possible preferential selection of CHWs from higher volume facilities.

A major strength of the qualitative data was drawing upon multiple perspectives from individuals closest to the program. However, there was no direct observation of CHW-client interactions to measure intervention fidelity, nor interviews with community members exposed to the dual role CHWs. Those techniques would have helped improve our understanding of *how* HIV and MNCH services were integrated during household visits and help determine the quality of CHW counseling provided. Respondent bias was also a potential concern, as interviewees might have shares opinions to try to please the researchers, however, researchers tried to limit this bias through stressing the importance of interview findings for determining necessary program improvements.

Closing Thoughts

This study contributes to an evidence gap in understanding HIV-MNCH service integration at

the community level, exploring factors that facilitated and inhibited attempts at integration. Findings also add to a small but growing body of literature around CHW role expansion beyond a single disease oriented scope of work. Considerations of task complexity, workload, and remuneration are important to integration decisions. Integrated models require more time and effort to improve services and cover a wider range of responsibilities. Realistic expectations of workload are needed to prevent CHW burnout and sustain motivation. This is particularly true for volunteer programs, but also relevant for the professional paid CHW programs. The findings from the quantitative research are tempered by qualitative findings that suggest stronger implementation and design choices are needed.

This study makes a strong case for the important work that volunteers contribute to the Community Based Health Program in Tanzania. It improves understanding of the varied scopes of work, feasibility, acceptance, and adoption of a newly integrated CHW program model. I hope this research supports health system strengthening in Tanzania at this critical juncture as the national CHW program is rolled out. Ongoing implementation research will be essential to answering questions regarding how best to continue provision of community-based services.

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Appendices

Appendix 1. In-depth interview guides

Data Collection Instrument A: Case Study, Iringa Region
Semi-Structured Interview Guide: Civil Society Organization Program Management Staff

Muhimbili University of Health and Allied Sciences (MUHAS) / Johns Hopkins Bloomberg School of Public Health, Funded by USAID
A Learning Agenda for the Development of Community Based Programs in Tanzania - Toward the Development of a Community Health Worker Cadre
JHSPH IRB: 00005497 /Version Date: October 18, 2015

Introduction
We are coming from Muhimbili University in Dar es Salaam and are working in collaboration with Johns Hopkins School of Public Health in the United States. We are conducting a study to assist the Ministry of Health and Social Welfare (MOHSW) and the National Community Health Worker (CHW) Task Force to understand perspectives on community health worker (CHW) role expansion, workload, and productivity among volunteer CHWs.

You have been selected to participate in this interview because of your experience working at a civil society organization to support implementation of the Home-Based Care (HBC) program in Iringa Region under Tunajali. We are interested in hearing about your experience in implementation of the HBC program and your insights will help in designing future CHW programs in Tanzania. The information you provide during this interview will be analyzed by our research team and will be represented in the form of documents to be presented to the Ministry of Health and Social Welfare and its National CHW Task Force.

All interview content will be completely anonymous. Your name will not be recorded or attached to your responses. We would also like to tape record this interview at your consent, so that we may not miss any important information that you provide. If at any point of this interview you wish to skip a question or you no longer wish to proceed, please feel free to let us know so that we may stop the interview process. There will be no consequence to you if you do not wish to participate.

Are you interested to participate in the study? ***If yes, please administer verbal consent form.***
May we tape record this interview? ***If no, simply take detailed notes.***

Utangulizi
Tunatokea chuo kikuu cha Muhimbili kilichopo Dar es Salaam tukishirikiana na chuo kikuu cha Johns Hopkins School of Public Health kilichopo marekani. Tunafanya utafiti kwa ajili ya kuisaidia wizara ya Afya Maendeleo ya jamii, Jinsia, Wazee na Watoto, pamoja na kikosi kazi cha wahudumu wa afya ya jamii ili kuweza kuelewa mitazamo ya wahudumu wa afya ya jamii katika kuongeza wigo wa majukumu yao na tija miongoni kwa wahudumu wa kujitolea wa Afya ya Jamii.

Umechaguliwa kushiriki katika utafiti huu kwa sababu ya uzoefu wako wa kufanya kazi katika asasi za kiraia katika kusaidiia utekelezaji wa Huduma za Afya Majumbani mkoani Iringa chini ya TUNAJALI. Tunapemba kusikia uzoefu wako juu ya utekelezaji wa programu ya Wahudumu Wa Afya majumbani pamoja na maoni yako ambayo yatasaidia kutengeneza programu ya wahudumu wa afya ya jamii kwa siku zijazo hapa nchini Tanzania. Taarifa utakazozitoa kipindi cha mahojiano haya zita fanyiwa uchambuzi na timu ya watafiti wetu na zitawasilishwa wizara ya afya na ustawi wa jamii na kikosi kazi chake zikiwa kwenye mfumo wa hati/kabrasha.

Mahojiano yote yatakua ni ya siri. Jina lako halitanakiliwa wala kuambatanishwa kwenye majibu yako. Na wakati wowote ukijisikia hupendi kujibu swali Fulani au huwezi tena kuendelea na mahojiano, tafadhali jisikie huru kutuambia ili tuweze kusitisha mchakato huu wa mahojiano. Hakuna athari yoyote utakayoipata endapo ukiamua kujiondoa kwenye mahojiano haya.

Upo tayari kushiriki kwenye utafiti huu? ***Kama jibu ni NDIYO endelea na mchakato wa fomu ya ridhaa ya mdomo.***

Je! Upo tayari nirekodi mahojiano haya na kinasa sauti? ***Kama ni Hapana nakili mahojiano/maelezo hayo kwa kina kabisa***

You have been asked to participate in in this interview because you work at a civil society organization that supports HBC program implementation in Iringa Region. The purpose of our discussion today is to hear about your perspectives on the HBC program. First, we will begin by asking a few background questions.

Umechaguliwa kushiriki katika utafiti huu kwa sababu ya uzoefu wako wa kufanya kazi katika asasi za kiraia zinazosaidia utekelezaji wa Huduma za Afya Majumbani mkoani Iringa. Lengo la mazungumzo haya ya leo ni kutaka kusikia mtazamo wako juu ya programu za huduma za afya majumbani. Kwa kuanza nitakuuliza maswali machache ya utangulizi.

Section 1. Background Questions / Sehemuya I: Maswali ya utangulizi

No.	A. Interview details	
001	**Date of Interview** Tarehe ya majadiliano	Day/ Siku: |___|___|
		Month/ Mwezi: |___|___|
		Year/ Mwaka: |___|___|___|___|
002	**Time of interview** Muda wa mahojiano	|___|___| : |___|___|
003	**Audio recording device number** Namba ya kinasa sauti	☐ 1 ☐ 2 ☐ 3 ☐ 4 ☐ 5 ☐ 6
004	**Interviewer ID Number** Namba ya utambulisho ya Mhojaji	|___|___|
005	**Location in Iringa** Sehemu Iringa	Name of Village/ Kijiji:
006		Name of Ward/ Kata:
007		Name of District Council/ Wilaya:
No.	**B. Facility Information** **Taarifa za Kituo cha Afya**	
008	**Name of civil society organization where interviewee works** Jina la asasi ya kiraia ambayo mhojiwa anafanyia kazi	☐ 1 - CSO: Afya Women Group kikundi cha Afya cha Wanawake ☐ 2 - CSO: Iringa Mercy Organization asasi ya Huruma ya Iringa
009	**How long have you worked at this CSO?** Ni kwa muda gani umefanya kazi kwenye hii asasi ya kiraia?	|___|___| years / Miaka |___|___| months / Miezi
010	**What is your job title at the CSO?** Una cheo gani kwenye hii asasi ya Kiraia?	

Section 2. Role within CSO, programmatic context, plus highlights & challenges of original Tunajali HBC program
Sehemu ya Pili: kazi za asasi za Kiraia, mazingira ya kiprogramu, dondoo na changamoto za programu ya Tunajali ya Huduma za afya majumbani

1. First, can you tell me about your role at…
   [*Insert CSO's name – Afya Women Group–or- Iringa Mercy Or*ganization]?
   Kwanza, unaweza kuniambia kazi zako kwenye…….
   [weka- Jina la Asasi ya kiraia- kikundi cha Afya cha Wanawake- au asasi ya Huruma ya Iringa]

2. How long has this organization been involved in implementation of the HBC program?
   Ni kwa muda gani asasi hii imekua ikijihusisha na utekelezaji wa programu ya wahudumu wa afya majumbani?

3. What are the key elements of the HBC program in this district?
   Katika wilaya hii ni vitu gani vya msingi vilivyopo kwenye hii programu ya wahudumu wa afya wa majumbani?

4. Can you talk about how this organization supports the HBC program?
   Unaweza kuniambia ni kwa namna gani asasi/taasisi yako inavyosaidia programu ya huduma za afya majumbani

   Probes: dodosa
   - What is your interaction with home based care (HBC) CHWs at this organization?
     Ni nini mahusianao yako na wahudumu wa afya majumbani katika asasi hii?

   - How do you support management of Tunajali?
     Ni kwa namna gani unasaidia menejimenti ya Tunajali?

5. In your opinion, what are the main highlights (successes) of the original HBC program?
   [Clarify "original" means prior to the recent expansion into MNCH tasks]
   Kwa maoini yako, kuna mafanikio gani kutokana na programu ya asili ya huduma za afya majumbani?
   [fafanua 'asili' maana yake ni kabla ya upanuzi wa hivi karibuni kwenda kwenye shughuli za MNC]

6. In your opinion, what are the main challenges of the original HBC program?
   [Clarify "original" means prior to the recent expansion into MNCH tasks]
   Kwa maoni yako, ni changamoto gani zinazoikabili programu ya asili ya wahudumu wa afya majumbani?
   [fafanua 'asili' maana yake ni kabla ya upanuzi wa hivi karibuni kwenda kwenye shughuli za MNC]

Section 3. Adding maternal, newborn, and child health tasks to the HBC program
Sehemu ya Tatu. Kuongeza majukumu ya afya ya uzazi, watoto wachanga na afya ya mtoto kwenye programu ya huduma za afya majumbani

Now we'd like to ask you specific questions about the recent change to the HBC program to add maternal, newborn, and child health activities within Tunajali

Sasa ningependa kukuuliza maswali mahususi kuhusu mabadiliko ya hivi karibu kwenye programu ya huduma za afya majumbani ndani ya asasi ya TUNAJALI kwa kuongeza majukumu ya afya ya uzazi, watoto wachanga na afya ya mtoto

7. Some HBCs at your organization were recently trained on maternal, newborn and child health (MNCH). In what ways were you involved in this aspect of the program?
   Kwenye asasi/taasisi yako kuna baadhi ya wahudumu wa afya majumbani hivi karibuni wamepatiwa mafunzo ya afya ya uzazi, watoto wachanga na afya ya mtoto{MNCH), Je ni kwa namna gani wewe ulihusika kwenye programu hiyo?

8. How were HBCs in your district selected to receive the training on MNCH?
   Kwenye wilaya yako ni kwa namna gani hawa wahudumu wa afya ya majumbani walichaguliwa kwenda kuhudhuria mafunzo ya MNCH?

   Probes: dodosa
   - Please describe the process for selection.
     Tafadhali elezea mchakato wa namna walivyochaguliwa

   - Why were they selected in this way?
     Kwa nini walichaguliwa kwa njia hii?

9. How were HBCs trained to add maternal, newborn, and child health responsibilities to their existing HIV workload?
   Ni jinsi gani wahudumu wa afya majumbani wamepewa mafunzo ya kuongeza majukumu ya afya ya uzazi, watoto wachanga na afya ya mtoto kwenye sehemu ya majukumu yao ya awali ya VVU?

   Probes: Dodosa
   - What guidance did HBCs receive about how to organize their day (or week) to cover both HIV and MNCH related tasks?
     Ni mwongozo gani wahudumu wa afya majumbani wamepewa kuhusiana na namna ya kuandaa kazi zao zao za kila siku au wiki kwa ajili ya kujuisha kazi zote mbili za VVU na MNCH?

10. What guidance did HBCs receive about specific HIV and MNCH tasks to perform in the same household visit and/or community meeting?
    Ni mwongozo gani mahususi wahudumu wa afya majumbani wamepewa katika kuweza kufanya kazi zote mbili za VVU na MNCH wakiwa wanatembelea kaya au jamii moja.

    Probes: Dodosa
    - Can you provide examples of how HBC-MNCH CHWs are expected to combine services within household visits?
      Unaweza kutoa mfano ni kwa jinsi gani HBC-MNC CHW wanatarajiwa kuchanganya/kujumuisha huduma hizo kwenye kaya watakazozitembelea?

Section 4. Perspectives on HIV-MNCH integration (role expansion)
Sehemu ya NNE: mitazamo juu ya kuchanganya huduma za VVU-MNCH (kuongeza majukumu)

While it is still early-on in implementation, next I'd like to ask about your opinions of the new model of CHWs providing <u>both</u> HIV and MNCH services

Wakati bado ikiwa ni mapema/awali mwa utekelezaji, kinachofuata napenda nikuulize juu ya maoni yako kuhusu aina mpya ya wahudumu wa afya ya jamii kutoa huduma zote za VVU na MNCH

11. So far, what are the main highlights (successes) of adding MNCH tasks to HBC CHW scope of work?
Mpaka sasa, je ni mafanikio gani yaliyopatikana kutokana na kuongeza hizi huduma za MNCH kwenye wigo wa kazi za HBC CHW?

    Probes: Dodosa
    - What do you think are the benefits to giving HBCs MNCH tasks to perform in addition to their HIV tasks?
      Je unafikiri kuna faida gani ya kuwapa HBCs MNCH kufanya kazi ya ziada/nyongeza kwenye majukumu yao ya mambo ya UKIMWI?

    - Do you think it's important to combine HIV and MNCH services at the community level?... Why or why not?
      Unafikiri kuna umuhimu katika ngazi ya jamii kuchanganya huduma za ukimwi na afya ya uzazi, watoto wachanga na afya ya mtoto? Kwa nini? Kwa nini HAPANA?

12. Similarly, so far, what are the main challenges of adding MNCH tasks to HBC CHW scope of work?
Sambamba na hii, kuna changamoto gani za kumuongezea majukumu ya kazi ya afya ya uzazi, watoto wachanga na afya ya mtoto (MNCH) mhudumu wa afya majumbani?

    Probes: Dodosa
    - What do you think are the drawbacks to giving HBCs MNCH tasks to perform in addition to their HIV tasks?
      je unafikiri kuna changamoto/matatizo gani ya kuwapa HBCs MNCH kazi ya nyongeza kwenye majukumu yao ya mambo ya UKIMWI?

Section 5. HBC CHW Performance
Sehemu ya Tano: Utendaji wa HBC CHW

13. Regarding client load: how has the catchment size (& number of households) changed with adoption of the combined HIV-MNCH model?
Kwa kuzingatia wingi wa wateja: ni kwa namna gani wingi wa idadi ya kaya limebadilika baada ya kuchanganya huduma za VVU na MNCH?

    Probes: Dodosa
    - Overall number of households covered per HBC-MNCH for HIV services?
      Jumla ya idadi ya kaya zinazohudumiwa na HBC-MNCH kwa huduma za ukimwi?

    - Overall number of households covered per HBC-MNCH for MNCH services?
      Jumla ya idadi ya kaya zinazohudumiwa na HBC-MNCH kwa huduma za afya ya uzazi, watoto wachanga na afya ya mtoto?

    - Expected number of household visits per week?
      Idadi ya kaya zilizotarajiwa kutembelewa kwa wiki?

    - How do you expect these new catchment sizes will affect HBC performance and overall service delivery?
      Unatarajia kutakua na athari zozote kwenye utendaji wa HBC kutokana na ukubwa wa eneo jipya la kufanyia kazi hasa katika kutoa huduma?

14. In what ways do you think the newly integrated HBC-MNCH cadre is performing well?
Ni kwa namna gani huduma mpya jumuishi ya HBC-MNCH inafanya vizuri?

Probes: Dodosa
- What do you think contributes to their success in this area?
Unafikiri nini kinachangia mafanikio hayo kwenye eneo hili?

15. In what ways do you think the newly integrated HBC-MNCH cadre is NOTperforming well?
Ni kwa namna gani i hudumu mpya jumuishi ya HBC-MNCH haifanyi vizuri?

16. What challenges have the HBC-MNCH CHWs faced?
Ni changamoto zipi zinazowakabili wahudumu wa afya ya jamii wa HBC-MNCH?

Probes: Dodosa
- Which of these challenges have been due to how the program was rolled out or implemented?
Ni changamoto zipi miongoni mwa hizi ulizozitaja zimejitokeza wakati wa utekelezaji wa programu hii?

17. What factors influence the ability of the CHW to combine HIV and MNCH services?
Ni mambo gani yanapelekea uwezo wa mhudumu wa afya ya jamii aweze kuchanganya huduma za UKIMWI na huduma za afya ya uzazi, watoto wachanga na afya ya mtoto?

Section 5. Workload balance across HIV and MNCH tasks
Sehemu ya Tano. Uwiano/usawa wa majukumu kati UKIMWI na afya ya uzazi, watoto wachanga na afya ya mtoto.

18. How well are HBCs balancing between their new MNCH tasks and their previous HIV tasks?
Ni kwa namna gani wahudumu wa afya ya majumbani wanaweza kumudu shughuli za afya ya uzazi, watoto wachanga na afya ya mtoto na zile za awali za masuala ya UKIMWI**?**

Probes: Dodosa
- Are certain activities prioritized over others? Why or why not?
Kuna kazi Fulani zinapewa kipaumbele zaidi ya zingine? Kwa nini? Kwa nini hapana?

- How are HBC-MNCH CHWs performing versus the HBC CHWs with regard HIV tasks such as loss-to-follow-up tracking and adherence counseling?
unazungumziaje utendaji kazi wa wahudumu wa afya majumbani-afya ya uzazi, watoto wachanga ukilingalisha na wahudumu wa afya majumbani kwenye kazi hasa za ufuatiliaji wa waliojitoa kwenye huduma na katika kuzingatia ushauri nasaha?

19. What differences have you noticed in how the HBCs conduct their work before and after the MNCH training? Please explain.
Ni tofauti gani ambazo umeziona katika utendaji kazi wa wahudumu wa afya majumbani kabla na baada ya kupata mafunzo ya afya ya uzazi, watoto wachanga na afya ya mtoto?
Tafadhali elezea.

Section 6. Program Acceptability
Sehemu ya Sita: Kukubalika kwa programu

20. How have supervisors responded to the combined HIV-MNCH CHW program?
Je! Wasimamizi wameitikiaje kuhusu kuchanganya programu za VVU-MNCH CHW?

21. How have HBCs responded to the combined HIV-MNCH CHW program?
Wahudumu wa afya majumbani wameitikiaje kuhusu kuchangaya huduma za VVU-MNCH CHW?

    Probes: Dodosa

    - What about the response among HBCs that were <u>not</u> trained on MNCH?
      Nini mwitikio wa wahudumu wa afya ya majumbani ambao hawajapata mafunzo ya MNCH?

    - Have they expressed interest in getting trained as well? why?
      Je wameonesha kutamani kupata mafunzo hayo pia? Kwa nini?

Section 7. Recomendations
Sehemu ya Saba: Mapendekezo

22. Based on your early perspectives, what changes to the combined HIV-MNCH CHW would you make to improve the program? Please describe.
    Kutokana na mitazamo yako ya awali, je ni mabadiliko gani yafanyike ili kuboresha hii programu ya VVU-MNCH CHW

23. Would you recommend the integrated HBC-MNCH model be adopted by all HBCs in this district?... Why or why not?
    Je unapendekeza muundo jumuishi wa HBC-MNCH uhusishe wahudumu wote wa afya majumbani katika wilaya hii? Kwa nini / kwa nini Hapana?

Data Collection Instrument B: Case Study, Iringa Region
Semi-Structured Interview Guide: <u>Regional Implementing Partner</u>

Muhimbili University of Health and Allied Sciences (MUHAS) / Johns Hopkins Bloomberg School of Public Health, Funded by USAID
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JHSPH IRB: 00005497 / Version Date: October 18, 2015

Introduction
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You have been selected to participate in this interview because of your experience working at the implementing partner to support the Home-Based Care (HBC) program in Iringa Region under Tunajali. We are interested in hearing about your perspectives on the HBC program, and your insights will help in designing future CHW programs in Tanzania. The information you provide during this interview will be analyzed by our research team and will be represented in the form of documents to be presented to the Ministry of Health and Social Welfare and its National CHW Task Force.

All interview content will be completely anonymous. Your name will not be recorded or attached to your responses. We would also like to tape record this interview at your consent, so that we may not miss any important information that you provide. If at any point of this interview you wish to skip a question or you no longer wish to proceed, please feel free to let us know so that we may stop the interview process. There will be no consequence to you if you do not wish to participate.

Are you interested to participate in the study? ***If yes, please administer verbal consent form.***
May we tape record this interview? ***If no, simply take detailed notes.***

Utangulizi
Tunatokea chuo kikuu cha Muhimbili kilichopo Dar es Salaam tukishirikiana na chuo kikuu cha Johns Hopkins School of Public Health kilichopo marekani. Tunafanya utafiti kwa ajili ya kuisaidia Wizara ya Afya Maendeleo ya Jamii, Jinsia, Wazee na Watoto, pamoja na kikosi kazi cha wahudumu wa afya ya jamii ili kuweza kuelewa mitazamo ya wahudumu wa afya ya jamii katika kuongeza wigo wa majukumu yao na tija miongoni kwa wahudumu wa kujitolea wa Afya ya Jamii.

Umechaguliwa kushiriki katika utafiti huu kwasababu ya uzoefu wako wa kufanya kazi katika kusaidiia utekelezaji wa Huduma za Afya Majumbani mkoani Iringa chini ya programu ya TUNAJALI. Tunapenda kusikia uzoefu wako juu ya utekelezaji wa programu ya Wahudumu Wa Afya majumbani pamoja na maoni yako ambayo yatasaidia kutengeneza programu ya wahudumu wa afya ya jamii kwa siku zijazo hapa nchini Tanzania.

Mahojiano yote yatakua ni ya siri. Jina lako halitanakiliwa wala kuambatanishwa kwenye majibu yako. Na wakati wowote ukijisikia hupendi kujibu swali Fulani au huwezi tena kuendelea na mahojiano, tafadhali jisikie huru kutuambia ili tuweze kusitisha mchakato huu wa mahojiano. Hakuna athari yoyote utakayoipata endapo ukiamua kujiondoa kwenye mahojiano haya.

Upo tayari kushiriki kwenye utafiti huu? ***Kama jibu ni NDIYO endelea na mchakato wa fomu ya ridhaa ya mdomo.***

Je! Upo tayari nirekodi mahojiano haya na kinasa sauti? ***Kama ni Hapana nakili mahojiano/maelezo hayo kwa kina kabisa***

You have been asked to participate in in this interview because you work at the implementing partner that supports HBC program implementation in Iringa Region. First, we will begin by asking a few background questions.

Umechaguliwa kushiriki katika utafiti huu kwa sababu ya uzoefu wako wa kufanya kazi katika asasi za kiraia zinazosaidia utekelezaji wa Huduma za Afya Majumbani mkoani Iringa. Lengo la mazungumzo haya ya leo ni kutaka kusikia mtazamo wako juu ya programu za huduma za afya majumbani. Kwa kuanza nitakuuliza maswali machache ya utangulizi.

Section 1. Background Questions / Sehemuya I: Maswaliyausuli

No.	A. Interview details	
001	**Date of Interview** Tarehe ya majadiliano	Day/ Siku: |___|___|
		Month/ Mwezi:|___|___|
		Year/ Mwaka: |___|___|___|___|
002	**Time of interview** Muda wa Mahojiano	|___|___| : |___|___|
003	**Audio recording device number** Namba ya kinasa sauti	☐ 1 ☐ 2 ☐ 3 ☐ 4 ☐ 5 ☐ 6
004	**Interviewer ID Number** Namba ya utambulisho cha Mhojaji	|___|___|
005	**Location in Iringa** Sehemu Iringa	Name of Village/ Kijiji:
006		Name of Ward/ Kata:
007		Name of District Council/ Wilaya:
No.	**B. Facility Information** Taarifa za Kituo cha Afya	
008	**How long have you worked at this organization?** Una muda gani unafanya kazi kwenye taasisi hii?	|___|___| years Miaka |___|___| months Miezi *Note: If less than 1 year, only enter months.* *If more than 1 year, enter number of years plus months*
009	**What is your job title?** Cheo chako?	

Section 2. Role within Deloitte / Sehemu ya Pili: Mchango wa Deloitte

24. First, can you tell me about your role at Deloitte?
    Kwanza, unaweza kuniambia majukumu yako hapa Deloitte?

    Probes: Dodosa
    - Under Tunajali specifically, what is your interaction with HBC CHWs? And with the CSOs?
      Chini ya TUNAJALI, Nini haswa uhusiano wako na HBC CHWs pamoja na CSOs?

    - How do you support management of Tunajali?
      Unaisaidiaje menejimenti ya TUNAJALI?

Section 3. Adding maternal, newborn, and child health tasks to the HBC program
Sehemu ya Tatu. Kuongeza majukumu ya afya ya uzazi, watoto wachanga na afya ya mtoto kwenye programu ya huduma za afya majumbani

Now we'd like to ask you specific questions about the recent change to the HBC program to add maternal, newborn, and child health activities within Tunajali:

Sasa ningependa kukuuliza maswali mahususi kuhusu mabadiliko ya hivi karibu kwenye programu ya huduma za afya majumbani ndani ya asasi ya TUNAJALI kwa kuongeza majukumu ya afya ya uzazi, watoto wachanga na afya ya mtoto

25. How were HBCs in your district selected to receive the training on MNCH?
    Kwenye wilaya yako ni kwa namna gani hawa wahudumu wa afya ya majumbani walichaguliwa kwenda kuhudhuria mafunzo ya MNCH?

    Probes: Dodosa
    - Please describe the process for selection.
      Tafadhali elezea mchakato wa namna walivyochaguliwa

    - Why were they selected in this way?
      Kwa nini walichaguliwa kwa njia hiyo?

26. How were HBCs trained to add maternal, newborn, and child health responsibilities to their existing HIV workload?
    Ni jinsi gani wahudumu wa afya majumbani wamepewa mafunzo ya kuongeza majukumu ya afya ya uzazi, watoto wachanga na afya ya mtoto kwenye sehemu ya majukumu yao ya awali ya VVU?

    Probes: Dodosa
    - What guidance did HBCs receive about how to organize their day (or week) to cover both HIV and MNCH related tasks?
      Ni mwongozo gani wahudumu wa afya majumbani wamepewa kuhusiana na namna ya kuandaa kazi zao zao za kila siku au wiki kwa ajili ya kujuisha kazi zote mbili za VVU na MNCH?

27. What guidance did HBCs receive about specific HIV and MNCH tasks to perform in the same household visit and/or community meeting?
    Ni mwongozo gani mahususi wahudumu wa afya majumbani wamepewa katika kuweza kufanya kazi zote mbili za VVU na MNCH wakiwa wanatembelea kaya au jamii moja?
    Probes: Dodosa
    - Can you provide examples of how HBC-MNCH CHWs are expected to combine services within household visits?
      Unaweza kutoa mfano ni kwa jinsi gani HBC-MNC CHW wanatarajiwa kuchanganya / kujumuisha huduma hizo kwenye kaya watakazozitembelea?

Section 4. Perspectives on HIV-MNCH integration (role expansion)
Sehemu ya NNE: mitazamo juu ya kuchanganya huduma za VVU-MNCH (kuongeza majukumu)

While it is still early-on in implementation, next I'd like to ask about the new model of CHWs providing <u>both</u> HIV and MNCH services:

Wakati bado ikiwa ni mapema/awali mwa utekelezaji, kinachofuata napenda nikuulize juu ya maoni yako kuhusu aina mpya ya wahudumu wa afya ya jamii kutoa huduma zote za VVU na MNCH

28. Are there differences between the CSOs (Afya Women Group and Iringa Mercy Organization) in terms of how they are implementing the addition of MNCH tasks to the HBC CHW cadre? Please describe.
Kuna utofauti wowote miongoni mwa CSOs-asasi za kiraia (kikundi cha afya cha akina mama na asasi ya Huruma ya Iringa) katika utekelezaji wa majukumu ya nyogeza ya MNCH kwa kada ya HBC CHW. Tafadhali elezea

    Probes: Dodosa
    - Why are they implementing differently?
      Kwa nini wanatekeleza tofauti?

    - What implications do you expect from the different implementation processes?
      Je ni matokeo gani unayoyategemea kutokana na michakato tofauti ya utekelezaji?

29. So far, what are the main highlights (successes) of adding MNCH tasks to HBC CHW scope of work?
Mpaka sasa, je ni mafanikio gani yaliyopatikana kutokana na kuongeza hizi huduma za MNCH kwenye wigo wa kazi za HBC CHW?

    Probes: Dodosa
    - What do you think are the benefits to giving HBCs MNCH tasks to perform in addition to their HIV tasks?
      Je unafikiri kuna faida gani ya kuwapa HBCs MNCH kufanya kazi ya ziada/nyongeza kwenye majukumu yao ya mambo ya UKIMWI?

    - Do you think it's important to combine HIV and MNCH services at the community level?... Why or why not?
      Unafikiri kuna umuhimu katika ngazi ya jamii kuchanganya huduma za ukimwi na afya ya uzazi, watoto wachanga na afya ya mtoto? Kwa nini? Kwa nini HAPANA?

30. Similarly, so far, what are the main challenges of adding MNCH tasks to HBC CHW scope of work?
Sambamba na hii, kuna changamoto gani za kumuongezea majukumu ya kazi ya afya ya uzazi, watoto wachanga na afya ya mtoto (MNCH) mhudumu wa afya majumbani?

    Probes: Dodosa
    - What do you think are the drawbacks to giving HBCs MNCH tasks to perform in addition to their HIV tasks?
      Je unafikiri kuna changamoto/matatizo gani ya kuwapa HBCs MNCH kazi ya nyongeza kwenye majukumu yao ya mambo ya UKIMWI?

Section 5. HBC CHW Performance / Sehemu ya Tano: Utendaji wa HBC CHW

31. Regarding client load: how has the catchment size (& number of households) changed with adoption of the combined HIV-MNCH model?
Kwa kuzingatia wingi wa wateja: ni kwa namna gani wingi wa idadi ya kaya limebadilika baada ya kuchanganya huduma za VVU na MNCH?

    Probes: Dodosa
    - Overall number of households covered per HBC-MNCH for HIV services?
      Jumla ya idadi ya kaya zinazohudumiwa na HBC-MNCH kwa huduma za ukimwi?

- Overall number of households covered per HBC-MNCH for MNCH services?
  Jumla ya idadi ya kaya zinazohudumiwa na HBC-MNCH kwa huduma za afya ya uzazi, watoto wachanga na afya ya mtoto?

- Expected number of household visits per week?
  Idadi ya kaya zilizotarajiwa kutembelewa kwa wiki?

- How do you expect these new catchment sizes will affect HBC performance and overall service delivery?
  Unatarajia kutakua na athari zozote kwenye utendaji wa HBC kutokana na ukubwa wa eneo jipya la kufanyia kazi hasa katika kutoa huduma?

32. In what ways do you think the newly integrated HBC-MNCH cadre is performing well?
    Ni kwa namna gani huduma mpya jumuishi ya HBC-MNCH inafanya vizuri?

    Probes: Dodosa
    - What do you think contributes to their success in this area?
      Unafikiri nini kinachangia mafanikio hayo kwenye eneo hili?

33. In what ways do you think the newly integrated HBC-MNCH cadre is NOT performing well?
    Ni kwa namna gani i hudumu mpya jumuishi ya HBC-MNCH haifanyi vizuri?

Section 6. Program Acceptability / Sehemu ya Sita : Kukubalika kwa programu

34. How have the council health management team (CHMT) responded to the combined HIV-MNCH CHW program?
    Je ni kwa jinsi gani timu ya usimamizi wa afya ya katika ngazi ya halmashauri inaitikia wito wa kujumuisha programu hizi mbili za VVU na MNCH?

35. How have the CSOs responded to the combined HIV-MNCH CHW program?
    Ni kwa namna gani asasi za kiraia zinaitikia wito wa kujumuisha hizi programu za VVU-MNCH CHW?

36. How have the HBCs responded to the combined HIV-MNCH CHW program?
    Ni kwa namna gani wahudumu wa afya majumbani wameitikia juu ya kujumuisha programu ya VVU-MNCH CHW?

Section 7. Recommendations / Sehemu ya Saba: Mapendekezo

37. Based on your early perspectives, what changes to the combined HIV-MNCH CHW would you make to improve the program? Please describe.
    Kutokana na mitazamo yako ya awali, je ni mabadiliko gani yafanyike ili kuboresha hii programu ya VVU-MNCH CHW

38. Would you recommend the integrated HBC-MNCH model be adopted by all HBCs in this region?... Why or why not?
    Je unapendekeza muundo jumuishi wa HBC-MNCH uhusishe wahudumu wote wa afya majumbani katika mkoa huu? Kwa nini / kwa nini Hapana?

Data Collection Instrument C: Case Study, Iringa Region
Semi-Structured Interview Guide: HBC Supervisors

Muhimbili University of Health and Allied Sciences (MUHAS) / Johns Hopkins Bloomberg School of Public Health, Funded by USAID
A Learning Agenda for the Development of Community Based Programs in Tanzania - Toward the Development of a Community Health Worker Cadre
JHSPH IRB: 00005497 / Version Date: October 18, 2015

Introduction
We are coming from Muhimbili University in Dar es Salaam and are working in collaboration with Johns Hopkins School of Public Health in the United States. We are conducting a study to assist the Ministry of Health and Social Welfare (MOHSW) and the National Community Health Worker (CHW) Task Force to understand community health worker (CHW) perspectives on role expansion, workload, and productivity among volunteer CHWs.

You have been selected to participate in this interview because of your experience supervising Home-Based Care (HBC) workers in Iringa Region under the Tunajali program. Your insights on supervision will help in designing future CHW programs in Tanzania. The information you provide during this interview will be analyzed by our research team and will be represented in the form of documents to be presented to the Ministry of Health and Social Welfare and its National CHW Task Force.

All interview content will be completely anonymous. Your name will not be recorded or attached to your responses. We would also like to tape record this interview at your consent, so that we may not miss any important information that you provide. If at any point of this interview you wish to skip a question or you no longer wish to proceed, please feel free to let us know so that we may stop the interview process. There will be no consequence to you if you do not wish to participate.

Are you interested to participate in the study? ***If yes, please administer verbal consent form.***
May we tape record this interview? ***If no, simply take detailed notes.***

Utangulizi
Tunatokea chuo kikuu cha Muhimbili kilichopo Dar es Salaam tukishirikiana na chuo kikuu cha Johns Hopkins School of Public Health kilichopo marekani. Tunafanya utafiti kwa ajili ya kuisaidia wizara ya Afya na Ustawi wa Jamii (MOHSW) pamoja na kikosi kazi cha wahudumu wa afya ya jamii (CHW) ili kuweza kuelewa mitazamo ya wahudumu wa afya ya jamii(CHW) katika kuongeza wigo wa majukumu yao na tija miongoni mwa wahudumu wa kujitolea wa Afya ya Jamii(CHW).

Umechaguliwa kushiriki katika utafiti huu kwa sababu ya uzoefu wako wa kuwasimamia wahudumu wa Afya Majumbani mkoani Iringa chini ya programu ya TUNAJALI. Mtazamo wako juu ya usimamizi utasaidia kutengeneza programu ya wahudumu wa afya ya jamii kwa siku zijazo hapa nchini Tanzania. Taarifa utakazozitoa kwenye mahojiano haya zita fanyiwa uchambuzi na timu ya watafiti wetu na zitawasilishwa wizara ya afya, ustawi wa jamii, wazee walemavu na watoto na kikosi kazi chake zikiwa kwenye mfumo wa hati/kabrasha.

Mahojiano yote yatakua ni ya siri. Jina lako halitanakiliwa wala kuambatanishwa kwenye majibu yako. Na wakati wowote ukijisikia hupendi kujibu swali fulani au huwezi tena kuendelea na mahojiano, tafadhali jisikie huru kutuambia ili tuweze kusitisha mchakato huu wa mahojiano. Hakuna athari yoyote utakayoipata endapo ukiamua kujiondoa kwenye mahojiano haya.

Upo tayari kushiriki kwenye utafiti huu? ***Kama jibu ni NDIYO endelea na mchakato wa fomu ya ridhaa ya mdomo.***

Je! Upo tayari nirekodi mahojiano haya na kinasa sauti? ***Kama ni Hapana nakili mahojiano/maelezo hayo kwa kina kabisa***

You have been asked to participate in this interview because you provide supervision support to home-based care (HBC) CHWs. The purpose of our discussion today is to hear about your experiences in providing supervision to HBC CHWs in Iringa Region. First, we will begin by asking a few background questions.

Umeombwa kushiriki katika utafiti huu kwa sababu ya uzoefu wako wa kufanya kazi kama msimamizi katika kusaidia programu ya Huduma za Afya Majumbani mkoani Iringa. Lengo la mazungumzo haya ya leo ni kutaka kusikia uzoefu wako juu ya programu za huduma za afya majumbani mkoani Iringa. Kwa kuanza nitakuuliza maswali machache ya utangulizi.

Section 1. Background Questions / Sehemu ya 1: Maswali ya utangulizi

No.	A. Interview details	
001	**Date of Interview** Tarehe ya majadiliano	Day/ Siku: |___|___|
		Month/ Mwezi:|___|___|
		Year/ Mwaka: |___|___|___|___|
002	**Time of interview** Muda wa Mahojiano	|___|___| : |___|___|
003	**Audio recording device number** Namba ya kinasa sauti	☐ 1 ☐ 2 ☐ 3 ☐ 4 ☐ 5 ☐ 6
004	**Interviewer ID Number** Namba ya utambulisho cha Mhojaji	|___|___|
005	**Location in Iringa** Mahali Iringa	Name of Village/ Kijiji:
006		Name of Ward/ Kata:
007		Name of District Council/ Wilaya:
No.	**B. Supervisor's location** Eneo la Msimamizi	
008	**Is the supervisor based at a health facility or based at one of the CSOs?** Je Msimamizi anapatikana kwenye kituo cha afya, au miongoni kati ya asasi za kiraia?	☐ 1 – Health Facility kituo cha afya ☐ 2 – CSO: Afya Women Group Asasi ya kiraia ya kikundi cha afya cha wanawake ☐ 3 – CSO: Iringa Mercy Organization Aasi ya huruma ya Iringa
009	**If supervisor is based at a facility, what is the name of the facility?** Kama msimamizi anapatikana kwenye kituo cha afya, kinaitwaje hicho kituo cha afya?	_____
010	**If supervisor is based at a facility, what type of health facility is it?** Kama msimamizi anapatikana kwenye kituo cha afya, je ni aina gani ya kituo cha afya?	☐ 1 – Dispensary / Zahanati ☐ 2 – Health center / Kituo cha afya ☐ 3 – District hospital / Hospitali ya wilaya ☐ 4 – Regional hospital / Hospitali ya mkoa ☐ 5 – Other, specify / Nyingine, taja:_____

011	**Most common mode of travel to conduct community-based supervision?** Je ni njia gani ya usafiri iliyozoeleka kwenda kufanya usimamizi wa Jamii?	☐ 1 – On foot/ Kwa miguu ☐ 2 – Bicycle/ Baiskeli ☐ 3 – Motorcycle/ Pikipiki ☐ 4 – Public bus/ Dala dala ☐ 5 – Other, specify: / Nyingine, taja: _____
012	**Average time spent conducting supervision of HBCs each month (hours)** Kwa wastani ni muda gani unatumia katika kumsimamia kila mhudumu wa afya majumbani	|___|___| hours Saa
No.	**C. Supervisor's Demographics and Background** **Taarifa binafsi za msimamizi pamoja na historia yake**	
013	**Age** Umri	|___|___| Years / Miaka
014	**Sex** Jinsia	☐ 1 – Male/ Mwanamume ☐ 2 – Female/ Mwanamke
015	***If based at health facility*:** **Job title / qualification** ***Kama ni kwenye kituo cha afya:*** Cheo/ sifa	☐ 1 – Medical attendant / Muhudumu wa afya ☐ 2 – Clinical assistant / Tabibu Msaidizi ☐ 3 – Enrolled nurse / Muuguzi aliyesajiliwa ☐ 4 – Clinical officer / Tabibu ☐ 5 – Assistant medical officer / Daktari msaidizi ☐ 6 – Medical doctor / Daktari ☐ 9 – Other, specify: / wengineo, Taja _____
016	**How many HBCs do you supervise in total?** Ni wahudumu wangapi wa afya majumbani unaowasimamia?	|___|___| Number of HBCs Idadi ya wahudumu wa afya wa majumbani
017	**How long have you been working as supervisor of HBC program in this facility/civil society organization?** Ni kwa muda gani umekuwa msimamizi wa programu hii ya HBC katika kituo hiki/asasi za kiraia	|___|___| Years |___|___| Months

Section 2. Introduction and details of HBC program
Sehemu ya Pili: Utangulizi na maelezo ya programu ya Wahudumu wa afya ya majumbani

1. Tell us about what you do in relation to the HBC program in this district?
   Tueleze mnafanya nini kuhusiana na programu ya HBC katika wilaya hii

   Probe: Dodosa
   - Please tell me about your roles at this facility (or civil society organization)?
     Tafadhali nieleze kuhusu majukumu/nafasi yako katika kituo hiki cha afya (au asasi ya kiraia)

   - How long have you been working at this particular facility/civil society organization?
     Ni kwa muda gani umekua ukifanya kazi kwenye kituo hiki cha afya/ asasi ya kiraia?

Section 3. HBC Supervision tasks
Sehemu ya Tatu: Majukumu ya Usimamizi ya wahudumu wa afya majumbani

2. What kind of HBC supervision tasks are you responsible for?
   Ni aina gani ya kazi za usimamizi unazozifanya kwa wahudumu wa afya majumbani?

   Probes: Dodosa
   - When you provide supportive supervision, what do you actually do?
     Wakati unapofanya usimamizi shirikishi ni mambo gani unafanya hasa?

   - Describe your supervisory role in supporting the HBCs.
     Elezea nafasi yako katika kusaidia usimamizi wa wahudumu wa afya majumbani ***(Kumbuka kumuliza juu ya usimamizi wake kwenye programu ya HBC, MNCH au zote)***

   - If you only supervise HIV-only or MNCH-only, is there another supervisor to cover the other topics?... who is the other person?
     Kama wewe unasimamia huduma za UKIMWI tu au Huduma za afya ya uzazi watoto wachanga na afya ya watoto tu, je kuna msimamizi mwingine anaeshughulia huduma zingine?

3. How often are supervisory visits intended to occur? At the facility or community level? (***Remember to ask what they do exactly?)***
   Kiutaratibu unatakiwa kufanya usimamizi mara ngapi? Kwenye ngazi ya kituo cha afya au ngazi ya jamii? (***Kumbuka kuuliza wanafanya nini hasa?)***

   Probes: dodosa
   - Are you able to meet this expectation for frequency of supervision visits?
     Je unawezaje kufikia matarajio haya kwa kufanya usimamizi wa mara kwa mara?

   - If irregular: What barriers do you face in conducting regular supervision?
     Kama siyo mara kwa mara. Ni vikwazo gani unavyokutana navyo katika kufanya usimamizi wa mara kwa mara?

4. Some HBCs were recently trained on MNCH. What does the combination of HIV and MNCH services by CHWs mean for your work as a HBC supervisor?
   Kuna baadhi ya wahudumu wa afya majumbani wamepatiwa mafunzo ya afya ya uzazi watoto wachanga na afya ya watoto. Ukiwa kama msimamizi wa wahudumu wa afya majumbani Je! muunganiko huu wa wahuduma za UKIMWI na afya ya uzazi watoto wachanga na afya ya watoto umeleta mabadiliko gani katika majukumu yako ya usimamizi?

5. What data do you review with HBCs when you meet with them?
   Ni taarifa gani mnazipitia unapokutana na wahudumu wa afya ya majumbani?

   Probes: Dodosa
   - What these meetings are like?
     Mikutano inakuaje?

   - If you don't review household level data with the HBCs, why not?
     Kama hampitii taarifa za ngazi ya kaya na mhudumu wa afya majumbani, ni kwa nini?

   - How do you use the data collected at the community-level? For example, for future planning, goal setting, or other reasons?
     Unazitumiaje taarfia zilizokusanywa kwenye ngazi ya jamii? Kwa mfano kwa ajili ya mipango ya baadaye, kuweka malengo au kwa sababu zingine?

Section 4: Perspectives on HIV-MNCH integration (role expansion)
Sehemu ya Nne: mitazamo juu ya kuchanganya huduma za VVU-MNCH (kuongeza majukumu)

While it is still early-on in implementation, next I'd like to ask about your opinions of the new model of CHWs providing <u>both</u> HIV and MNCH services:

Wakati bado ikiwa ni mapema/awali mwa utekelezaji, kinachofuata napenda nikuulize juu ya maoni yako kuhusu aina mpya ya wahudumu wa afya ya jamii kutoa huduma zote za VVU na MNCH

6. So far, what are the main <u>highlights</u> (successes) of adding MNCH tasks to HBC CHW scope of work?

Mpaka sasa, je ni mafanikio gani yaliyopatikana kutokana na kuongeza hizi huduma za MNCH kwenye wigo wa kazi za wahuduma wa afya majumbani?

Probes: Dodosa
What do you think are the benefits to giving HBCs MNCH tasks to perform in addition to their HIV tasks? Je unafikiri kuna faida gani ya kuwapa HBCs MNCH kufanya kazi ya ziada/nyongeza kwenye majukumu yao ya mambo ya UKIMWI?

Do you think it's important to combine HIV and MNCH services at the community level?... Why or why not? Unafikiri kuna umuhimu wa kuunganisha huduma za ukimwi na afya ya uzazi, watoto wachanga na afya ya mtoto? Kwa nini? Kwa nini HAPANA?

7. Similarly, so far, what are the main <u>challenges</u> of adding MNCH tasks to HBC CHW scope of work?

Sambamba na hayo, mpaka sasa kuna changamoto zipi zinazotokana na kumuongezea majukumu MNCH kwa wahudumu wa afya majumbani?

Probes: Dodosa
What do you think are the drawbacks to giving HBCs MNCH tasks to perform in addition to their HIV tasks? je unafikiri kuna changamoto/matatizo gani ya kuwapa HBCs MNCH kazi ya nyongeza kwenye majukumu yao ya mambo ya UKIMWI?

Section 5. HBC CHW Performance / Sehemu ya Tano: Utendaji wa HBC CHW

8. Regarding client load: how has the catchment size (& number of households) changed with adoption of the combined HIV-MNCH model?
   Kwa kuzingatia wingi wa wateja: ni kwa namna gani wingi wa idadi ya kaya limebadilika baada ya kuchanganya huduma za VVU na MNCH?

   Probes: Dodosa
   - Overall number of households covered per HBC-MNCH <u>for HIV services</u>?
     Jumla ya idadi ya kaya zinazohudumiwa na HBC-MNCH kwa huduma za ukimwi?

   - Overall number of households covered per HBC-MNCH <u>for MNCH services</u>?
     Jumla ya idadi ya kaya zinazohudumiwa na HBC-MNCH kwa huduma za afya ya uzazi, watoto wachanga na afya ya mtoto?

   - Expected number of household visits per week?
     Idadi ya kaya zilizotarajiwa kutembelewa kwa wiki?

   - How do you expect these new catchment sizes will affect HBC performance and overall service delivery?
     Unatarajia kutakua na athari zozote kwenye utendaji wa HBC kutokana na ukubwa wa eneo jipya la kufanyia kazi hasa katika kutoa huduma?

9. In what ways do you think the newly integrated HBC-MNCH cadre is performing well?
   Ni kwa namna gani huduma mpya jumuishi ya HBC-MNCH inafanya vizuri?

   Probes: Dodosa
   - What do you think contributes to their success in this area?
     Unafikiri nini kinachangia mafanikio hayo kwenye eneo hili?

10. In what ways do you think the newly integrated HBC-MNCH cadre is <u>NOT</u> performing well?
    Ni kwa namna gani i hudumu mpya jumuishi ya HBC-MNCH haifanyi vizuri?

11. What challenges have the HBC-MNCH CHWs faced?
    Ni changamoto zipi zinazowakabili wahudumu wa afya ya jamii wa HBC-MNCH?

    Probes: Dodosa
    - Which of these challenges have been due to how the program was rolled out or implemented?
      Ni changamoto zipi miongoni mwa hizi ulizozitaja zimejitokeza wakati wa utekelezaji wa programu hii?

    - How have you tried to help the CHWs address these challenges?
      Ni kwa jinsi gani umejaribu kuwasaidia wahudumu wa afya ya jamii katika kutatua changamoto hizi?

12. What factors influence the ability of the CHWs to combine HIV and MNCH services?
    Ni mambo gani yanapelekea uwezo wa mhudumu wa afya ya jamii aweze kuchanganya huduma za UKIMWI na huduma za afya ya uzazi, watoto wachanga na afya ya mtoto?

Section 6. Workload balance across HIV and MNCH tasks
Sehemu ya Sita. Uwiano/usawa wa majukumu kati UKIMWI na afya ya uzazi, watoto wachanga na afya ya mtoto.

13. How well are HBCs balancing between their new MNCH tasks and their previous HIV tasks?
    Ni kwa namna gani wahudumu wa afya ya majumbani wanaweza kumudu shughuli za afya ya uzazi, watoto wachanga na afya ya mtoto na zile za awali za masuala ya UKIMWI**?**

    Probes: Dodosa
    - How are HBC-MNCH CHWs performing versus the HBC CHWs with regard HIV tasks such as loss-to-follow-up tracking and adherence counseling?
      Unazungumziaje utendaji kazi wa wahudumu wa afya majumbani-afya ya uzazi, watoto wachanga ukilingalisha na wahudumu wa afya majumbani kwenye kazi hasa za ufuatiliaji wa waliojitoa kwenye huduma na katika kuzingatia ushauri nasaha?

14. How do the HBC-MNCH CHWs decide which activities to conduct each day?
    Ni kwa namna gani wahudunmu wa afya wa HBC-MNCH wana aamua shughuli/kazi gani ifanyike kwa kila siku?

    Probes: dodosa
    - Are certain activities prioritized over others? Why or why not?
      Kuna kazi Fulani zinapewa kipaumbele zaidi ya zingine? Kwa nini? Kwa nini hapana?

15. What differences have you noticed in how the HBCs conduct their work before and after the MNCH training? Please explain.
    Ni tofauti gani ambazo umeziona katika utendaji kazi wa wahudumu wa afya majumbani kabla na baada ya kupata mafunzo ya afya ya uzazi, watoto wachanga na afya ya mtoto? Tafadhali elezea.

Section 7. Program Acceptability
Sehemu ya Saba: Kukubalika/kupokelewa kwa programu

16. Are community members aware that HBCs now provide both HIV and MNCH services?
    Je wanajamii wanauelwa kuhusu mabadiliko ya huduma jumishi za VVU na MNCH zinazotolewa na wahudumu wa afya majumbani?

    Probes: Dodosa
    - How has the community responded to the combined HIV-MNCH CHW services?
      Je wanajamii wameitikiaje juu ya kuunganishwa kwa huduma hizi mbili?

17. How have HBCs responded to the combined HIV-MNCH CHW program?
    Wahudumu wa afya majumbani wameitikiaje kuhusu kuchangaya huduma za VVU-MNCH CHW?

    Probes: Dodosa
    - What about the response among HBCs that were <u>not</u> trained on MNCH?…
      Nini mwitikio wa wahudumu wa afya ya majumbani ambao hawajapata mafunzo ya MNCH?
    - Have they expressed interest in getting trained as well? Why?
      Je wameonesha kutamani kupata mafunzo hayo pia? Kwa nini?

Section 8. Recommendations
Sehemu ya Nane: Mapendekezo

18. Based on your early perspectives, what changes to the combined HIV-MNCH CHW would you make to improve the program? Please describe.
    Kutokana na mitazamo yako ya awali, je ni mabadiliko gani yafanyike ili kuboresha hii programu ya VVU-MNCH CHW

19. Would you recommend the integrated HBC-MNCH model be adopted by all HBCs in this district?... Why or why not?
    Je unapendekeza muundo jumuishi wa HBC-MNCH uhusishe wahudumu wote wa afya majumbani katika wilaya hii? Kwa nini/ kwa nini Hapana?

Data Collection Instrument D: Case Study, Iringa Region
Semi-Structured Interview Guide: HBC-only CHWs (Single Role)

Muhimbili University of Health and Allied Sciences (MUHAS) / Johns Hopkins Bloomberg School of Public Health, Funded by USAID
A Learning Agenda for the Development of Community Based Programs in Tanzania - Toward the Development of a Community Health Worker Cadre
JHSPH IRB: 00005497 / Version Date: October 18, 2015

Introduction
We are coming from Muhimbili University in Dar es Salaam and are working in collaboration with Johns Hopkins School of Public Health in the United States. We are conducting a study to assist the Ministry of Health, Community Development, Gender, Elderly, and Children (MoH) and the National Community Health Worker (CHW) Task Force to understand community health worker (CHW) perspectives on role expansion, workload, and productivity among volunteer CHWs.

You have been selected to participate in this interview because of your experience working as a Home-Based Care (HBC) worker in Iringa Region under the Tunajali program. We are interested in hearing about your experience as a HBC in your community. Your insights will help in designing future CHW programs in Tanzania. The information you provide during this interview will be analyzed by our research team and will be represented in the form of documents to be presented to the Ministry of Health and its National CHW Task Force.

All interview content will be completely anonymous. Your name will not be recorded or attached to your responses. We would also like to tape record this interview at your consent, so that we may not miss any important information that you provide. If at any point of this interview you wish to skip a question or you no longer wish to proceed, please feel free to let us know so that we may stop the interview process. There will be no consequence to you if you do not wish to participate.

Are you interested to participate in the study? ***If yes, please administer verbal consent form.***
May we tape record this interview? ***If no, simply take detailed notes.***

Utangulizi
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Umechaguliwa kushiriki katika utafiti huu kwa sababu ya uzoefu wako wa kuwa Mhudumu wa afya Majumbani (HBC) mkoani Iringa chini ya programu ya TUNAJALI. Tunapenda kusikia uzoefu wako juu ya utekelezaji wa programu ya Wahudumu Wa Afya majumbani pamoja na maoni yako ambayo yatasaidia kutengeneza programu ya wahudumu wa afya ya jamii kwa siku zausoni hapa nchini Tanzania. Taarifa utakazozitoa kipindi cha mahojiano haya zitafanyiwa uchambuzi na timu ya watafiti wetu na zitawasilishwa wizara ya afya, maendeleo ya jamii, jinsia, wazee na watoto na kikosi kazi chake zikiwa kwenye mfumo wa hati/kabrasha.

Mahojiano yote yatakua ni ya siri. Jina lako halitanakiliwa wala kuambatanishwa kwenye majibu yako. Na wakati wowote ukijisikia hupendi kujibu swali Fulani au huwezi tena kuendelea na mahojiano, tafadhali jisikie huru kutuambia ili tuweze kusitisha mchakato huu wa mahojiano. Hakuna athari yoyote utakayoipata endapo ukiamua kujiondoa kwenye mahojiano haya.

Upo tayari kushiriki kwenye utafiti huu? ***Kama jibu ni NDIYO endelea na mchakato wa fomu ya ridhaa yam domo.***

Je! Upo tayari nirekodi mahojiano haya na kinasa sauti? ***Kama ni Hapana nakili mahojiano/maelezo hayo kwa kina kabisa***

You have been asked to participate in in this interview because you are a home-based care CHW. The purpose of our discussion today is to hear about your experiences providing community health services and balancing your daily tasks and workload. First, we will begin by asking a few background questions.

Umechaguliwa kushiriki katika utafiti huu kwasababu wewe ni Mhudumu wa afya ya majumbani(HBC). Lengo la mazungumza haya ya leo ni kutaka kusikia mtazamo wako juu ya programu za huduma za afya majumbani. Kwa kuanza nitakuuliza maswali machache ya usuli.

Section 1. Background Questions / Sehemu ya I: Maswali ya usuli

No.	A. Interview details	
000	**HBC unique ID**	|___|___|___|___|___|___|___|___|
001	**Date of Interview** **Tarehe ya majadiliano**	Day/ Siku: |___|___|
		Month/ Mwezi:|___|___|
		Year/ Mwaka: |___|___|___|___|
002	**Time of interview Tarehe ya majadiliano**	|___|___| : |___|___|
003	**Audio recording device number** **Namba ya kinasa sauti**	☐ 1 ☐ 2 ☐ 3 ☐ 4 ☐ 5 ☐ 6
004	**Interviewer ID Number** **Namba ya utambulisho cha Mhojaji**	|___|___|
005	**Location in Iringa** Mahali	Name of Village/ Kijiji:
006		Name of Ward/ Kata:
007		Name of District Council/ Wilaya:
No.	**B. Facility Information Taarifa za Kituo cha Afya**	
008	**Name of health facility that you report to** Kituo cha kutolea huduma za afya unachopeleka taarifa.	_____
009	**Health Facility Type** **(of health facility you report to)** **Aina ya kituo cha afya** **(**unachopeleka taarifa.**)**	☐ 1 – Dispensary/ Zahanati ☐ 2 – Health center/ Kituo cha afya ☐ 3 – District hospital/ Hospitali ya wilaya ☐ 4 – Other, specify / Nyingine, taja:_____
010	**Distance to health facility you report to** **Umbali kutoka kituo cha afya** unachopeleka taarifa.	|___|___| Kilometers / Kilomita
011	**Most common mode of travel from home to health facility you report to**? Aina ya usafiri unaotumiwa kutoka nyumbani hadi kituo cha af unachopeleka taarifa	☐ 1 – On foot/ Kwa miguu ☐ 2 – Bicycle/ Baiskeli ☐ 3 – Motorcycle/ Pikipiki ☐ 4 – Public bus/ Dala dala ☐ 5 – Other, specify:/ Nyingine, taja: _____

012	**Average time from home to health facility you report to (minutes)** Muda kutoka nyumbani hadi kituo cha kutolea huduma za afya unachopeleka taarifa. (kwa dakika)	|___|___| Minutes / Dakika
013	**Most common mode of travel from home to household visits?** / Aina ya usafiri unaotumia kutoka nyumbani hadi kwenda kwenye kaya unazotembelea	☐ 1 – On foot/ Kwa miguu ☐ 2 – Bicycle/ Baiskeli ☐ 3 – Motorcycle/ Pikipiki ☐ 4 – Public bus/ Dala dala ☐ 5 – Other, specify:/ Nyingine, taja:_____
No.	**C. CHW Demographics**	
014	**Age** Umri	|___|___| Years / Mwaka
015	**Sex** Jinsi	☐ 1 – Male/ Mwanamume ☐ 2 – Female/ Mwanamke
016	**Marital Status** Hali ya ndoa	☐ 1 – Married/ Kaoa/olewa ☐ 2 – Single/ Hajaoa/Hajaolewa ☐ 3 – Cohabitating/ Anaishi na mwenza ☐ 4 – Widowed/widower/ Mjane/mgane ☐ 5 – Divorced/ kaachika/tengana
017	**Religion** Dini	☐ 1 – Christian / Mkristo ☐ 2 – Muslim / Muislamu ☐ 3 – Indigenous beliefs/Imani asili ☐ 4 – Other, specify/Nyingine, taja _____
018	**What is your highest level of education?** Kiwango cha juu cha elimu?	☐ 1 – No formal education/ Hakusoma ☐ 2 – Started primary school but did not complete / Hakumaliza shule ya msingi ☐ 3 – Completed Standard 7 / Amemaliza elemu ya ☐ 4 – Started secondary school but did not complete / Hakumaliza elemu ya sekondarimsingi ☐ 5 – Completed Form 4 / Kukamilika kidato cha 4 ☐ 6 – Completed Form 6 / Kukamilika kidato cha 6 ☐ 7 – Other, specify/ Nyingine, taja _____
019	**What type of other activities are you involved in to generate income?** *(Check all that apply – do NOT read the choices to the respondent… only check the activities that the respondent states unprompted)* **Ni shughuli gani nyingine unafanya kwa ajili ya kujiingizia kipato?** *(angalia zote zinazohusika-usimsomee mhojiwa…angalia shughuli/kazi ambazo mhojiwa anajibu)*	☐ 0 – None specified / Hakuna ☐ 1 – Agriculture farmer / Kilimo ☐ 2 – Livestock farmer / Ufugaji ☐ 3 – Shop attendant kuuza / Duka ☐ 4 – Waitress / Mhudumu ☐ 5 – Cook / Upishi ☐ 6 – Teacher / Mwalimu ☐ 7 – Construction / Ujenzi ☐ 8 – Other, specify: Ingine _____
020	**Time in service being a HBC** (if <1 year, fill in number of months) **Muda uliyofanya kazi kama Mhudumu wa afya majumbani** (kama ni chini ya mwaka mmoja, jaza idadi ya miezi)	|___|___| Months / |___|___| Years / Mwaka

Section 2. Community Health Career Narrative
Sehemu ya Pili: Masimulizi/Malezo ya Kazi ya Afya ya Jamii

Next, we'd like to hear about your experience in becoming a home-based care worker:
Sasa Napenda kusikia kutoka kwako juu ya uzoefu wako wa kua mfanyakazi wa afya majumbani

1. How did first get involved in health matters in your community?
   Kwanza uliwezaje kuingia kwenye masuala ya afya hapa kwenye jamii yako?

2. Have you ever received formal training in health? Please describe.
   Umewahi kupata mafunzo rasmi ya afya?

   Probes: Dodosa
   - When did you receive the training?
     Lini ulipata mafunzo?
   - What type of training have you received?
     Ni aina gani ya mafunzo ulipatiwa?
   - Who (organization or mentor) provided the training?
     Ni nani (asasi, mshauri) alitoa mafunzo hayo?
   - If participant doesn't mention HBC training, ask specifically about their experience receiving home-based care training and when they were trained…
     Endapo mshiriki hajataja mafunzo ya huduma za afya majumbani…. Uliza kuhusu uzoefu wake katika kupata mafunzo ya huduma za afya majumbani na ni lini walipatiwa mafunzo
   - What other health programs are you involved in? (volunteer or paid)
     Ni programu gani zingine za afya unazohusika nazo? (kujitolea au kulipwa)

Section 3. HIV Service Delivery / Sehemu ya Tatu: Utoaji wa huduma za UKIMWI

Now we'd like to ask about how you structure your community health activities on a daily basis:
Sasa, tunapenda kukuuliza kuhusu muundo gani unautumia kila siku kwenye shughuli za afya ya jamii?

3. Please tell me about your day-to-day activities in providing home-based care HIV services.
   Tafadhali nieleze kuhusiana na shughuli zako za kila siku za kutoa huduma za afya ya UKIMWI majumbani

   Probes: Dodosa
   - How many HIV clients do you serve in your catchment area?
     Ni wateja wangapi wenye virusi vya UKIMWI unawahudumia kwenye eneo lako?
   - What type of tasks or activities are you most commonly working on for HIV clients?
     Ni kazi gani unazozifanya mara kwa mara kila siku unazifanya unapofanyakazi na waathirka wa virusi wa UKIMWI?
   - How much time do you spend each day (or each week) providing services for HIV clients?
     Ni muda gani unatumia kwa kila siku (au kila wiki) katika kutoa huduma kwa wateja wenye virusi vya UKIMWI?

Section 4. Supervision / Sehemu ya Nne: Usimamizi

4. Please describe what kind of supervision support you receive for home-based care by a supervisor from your nearby dispensary or health center.
   Tafadhali elezea, ni aina gani ya usimamizi unaupata kutoka kwa msimamizi wa zahanati au kituo cha afya kilicho karibu yako

   Probes: Dodosa
   - What do you discuss?
     Mnajadili nini?
   - How often are you supervised by someone from the facility?
     Ni mara ngapi unasimamiwa na mtu kutoka kituo cha afya?
   - Where are you supervised? (Community/household level? Facility-based?)
     Unasimamiwa wapi? (kwenye jamii/ngazi ya kaya? Kituoni?)
   - What is the focus of the supervision?
     Usimamizi huo unalenga nini?
   - How does the supervision affect your work?
     Nini matokeo ya usimamizi wa kazi yako?
   - How do you feel after supervision?
     Unajisikiaje baada ya kusimamiwa?

5. Please describe what kind of supervision support you receive for home-based care by a supervisor from the civil society organization (Afya Women Group or Iringa Mercy Organization).
   Tafadhali elezea, ni aina gani ya msaada wa kiusimamizi unaupata kwa wasimamizi wa asasi za kiraia (kikundi cha afya cha wanawake au asasi ya huruma ya Iringa) kwa ajili ya huduma za afya majumbani

   Probes: Dodosa
   - What do you discuss?
     Mnajadili nini?
   - How often are you supervised by someone from the CSO?
     Ni mara ngapi unasimamiwa na mtu kutoka asasi ya kiraia?
   - Where are you supervised? (Community/household level? Facility-based? CSO-based?)
     Usimamizi huo unafanyika wapi? (kwenye jamii/ngazi ya kaya? Kituoni? Asasi za kiraia?)
   - What is the focus of the supervision?
     Usimamizi huo unalenga nini?
   - How does the supervision affect your work?
     Ni nini matokeo ya usimamizi huo?
   - How do you feel after supervision?
     Unajisikiaje baada ya kusimamiwa?

6. Does the supervisor go over your monthly household data with you?
   Je wewe na msimamizi mnapitia kwa pamoja taarifa za mwezi za kwenye kaya?

   Probes: Dodosa
   - What these meetings are like? / Mikutano hii inakuaje?

- If you don't review household level data with the supervisor, why not?
  Kama hampitii kwa pamoja na msimamizi taarifa za ngazi ya kaya, Kwa nini?

Section 5. HBC Work Satisfaction
Sehemu ya Tano: Kuridhishwa na kazi ya Mhudumu wa afya majumbani

Now we'd like to ask about your satisfaction with providing HIV services at the community level.
Sasa napenda nikuulize kuhusu kuridhishwa kwako katika kutoa huduma za UKIMWI kwenye ngazi ya jamii

7. How do you feel about working with the HBC program?
   Unajisikiaje kufanya kazi katika programu ya huduma za afya majumbani? Kwa nini?

8. In your opinion, what are the main highlights (successes) of the HBC program?
   Kwa maoni yako, ni mafanikio gani yanayotokana na programu ya huduma za afya majumbani?

9. In your opinion, what are the main challenges of the HBC program?
   Kwa maoni yako, ni changamoto gani yanayotokana na programu ya huduma za afya majumbani?

10. Some HBCs in this district received additional training on maternal, newborn, and child health (MNCH). Are you interested in providing both HIV and MNCH services to the community? Why/why not?
    Kuna baadhi ya wahudumu wa afya majumbani wamepatiwa mafunzo ya ziada juu ya afya ya uzazi, wototo wachanga na afya ya mtoto(MNCH), Je! Ungependa kutoa huduma zote mbili za HIV na MNCH kwenye jamii? Kwa nini? / kwa nini Hapana?

    Probes: Dodosa
    - Do you enjoy focusing on one health area (HIV), or would you rather be trained to provide more types of services? Why?
      Je, unafurahia kujikita kwenye eneo moja tu la afya (VVU) au ungependelea kupatiwa mafunzo ili utoe huduma zaidi ya moja? Kwa nini?

    - Do you think you would have enough time to work on tasks for HIV and tasks for MNCH?
      Unafikiri utakua na muda wa kutosha wa kufanya kazi za UKIMWI na afya ya uzazi, wototo wachanga na afya ya mtoto?

    - What challenges do you think there would be in doing both sets of activities well?
      Unafikiri ni changamoto zipi utakutana nazo kwa kufanya kazi/shughuli zote mbili?

Section 6. Program Acceptability / Sehemu ya Sita: Kukubalika kwa programu

11. How have community beneficiaries responded to the HBC CHW program?
Je! Nini mwitikio wa wanajamii wanaonufaika na programu ya HBC CHW?

Probes: Dodosa
- Why do you think they like (or dislike) the services provided by the HBC program?
  Kwa nini unafikiri wanpenda(au hawapendi) huduma zitolewazo na programu ya huduma za afya majumbani?

Section 7. Recommendations / Sehemu ya Saba: Mapendekezo

12. What changes to the HBC model would you make to improve the program? Please describe.
Ni mabadiliko gani unaweza kupendekeza kwa ajili ya kuboresha Muundo wa programu ya HBC? Tafadhali Elezea

Data Collection Instrument E: Case Study, Iringa Region
Semi-Structured Interview Guide: HBC-MNCH CHWs (Dual Role)

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All interview content will be completely anonymous. Your name will not be recorded or attached to your responses. We would also like to tape record this interview at your consent, so that we may not miss any important information that you provide. If at any point of this interview you wish to skip a question or you no longer wish to proceed, please feel free to let us know so that we may stop the interview process. There will be no consequence to you if you do not wish to participate.

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Upo tayari kushiriki kwenye utafiti huu? ***Kama jibu ni NDIYO endelea na mchakato wa fomu ya ridhaa yam domo.***

Je! Upo tayari nirekodi mahojiano haya na kinasa sauti? ***Kama ni Hapana nakili mahojiano/maelezo hayo kwa kina kabisa***

You have been asked to participate in in this interview because you are a home-based care CHW. The purpose of our discussion today is to hear about your experiences providing community health services and balancing your daily tasks and workload. First, we will begin by asking a few background questions.

Umechaguliwa kushiriki katika utafiti huu kwasababu wewe ni Mhudumu wa afya ya majumbani(HBC)-CHW. Lengo la mazungumza haya ya leo ni kutaka kusikia mtazamo wako juu ya programu za huduma za afya majumbani. Kwa kuanza nitakuuliza maswali machache ya usuli.

Section I. Background Questions / Sehemu ya I: Maswali ya usuli

No.	A. Interview details	
000	**HBC unique ID**	|___|___|___|___|___|___|___|___|
001	**Date of Interview** **Tarehe ya majadiliano**	Day/ Siku: |___|___|
		Month/ Mwezi:|___|___|
		Year/ Mwaka: |___|___|___|___|
002	**Time of interview Tarehe ya majadiliano**	|___|___| : |___|___|
003	**Audio recording device number** **Namba ya kinasa sauti**	☐ 1 ☐ 2 ☐ 3 ☐ 4 ☐ 5 ☐ 6
004	**Interviewer ID Number** **Namba ya utambulisho cha Mhojaji**	|___|___|
005	**Location in Iringa** Mahali	Name of Village/ Kijiji:
006		Name of Ward/ Kata:
007		Name of District Council/ Wilaya:
No.	**B. Facility Information Taarifa za kwenye Kituo cha Afya**	
008	**Name of nearest health facility** Kituo cha kutolea huduma za afya kilichopo karibu	_____
009	**Health Facility Type** **(of nearest health facility)** Aina ya kituo	☐ 1 – Dispensary/ Zahanati ☐ 2 – Health center/ Kituo cha afya ☐ 3 – District hospital/ Hospitali ya wilaya ☐ 4 – Regional hospital/ Hospitali ya mkoa ☐ 5 – Other, specify / Nyingine, taja:_____
010	**Distance to nearest health facility** **Umbali kutoka kituo cha afya kilichopo karibu**	|___|___| Kilometers / Kilomita
011	**Most common mode of travel from home to nearest health facility?** Aina ya usafiri unaotumiwa kutoka nyumbani hadi kituo cha afya kilichopo karibu?	☐ 1 – On foot/ Kwa miguu ☐ 2 – Bicycle/ Baiskeli ☐ 3 – Motorcycle/ Pikipiki ☐ 4 – Public bus/ Dala dala ☐ 5 – Other, specify:/ Nyingine, taja: _____

012	**Average time from home to nearest health facility (minutes)** / Muda kutoka nyumbani hadi kituo cha kutolea huduma za afya kilichopo karibu (kwa dakika)	|___|___| Minutes / Dakika
013	**Most common mode of travel from home to household visits?** / Aina ya usafiri unaotumiwa kutoka nyumbani hadi kituo cha afya kilichopo karibu?	☐ 1 – On foot/ Kwa miguu ☐ 2 – Bicycle/ Baiskeli ☐ 3 – Motorcycle/ Pikipiki ☐ 4 – Public bus/ Dala dala ☐ 5 – Other, specify:/ Nyingine, taja:_____
No.	**C. CHW Demographics**	
014	**Age** Umri	|___|___| Years / Mwaka
015	**Sex** Jinsia	☐ 1 – Male/ Mwanamume ☐ 2 – Female/ Mwanamke
016	**Marital Status** Hali ya ndoa	☐ 1 – Married/ Kaoa/olewa ☐ 2 – Single/ mseja ☐ 3 – Cohabitating/ Anaishi na mwenza ☐ 4 – Widowed/widower/ Mjane/mgane ☐ 5 – Divorced/ kaachika/tengana
017	**Religion** Dini	☐ 1 – Christian / Mkristo ☐ 2 – Muslim / Muislamu ☐ 3 – Indigenous beliefs/Imani asili ☐ 4 – Other, specify/Nyingine, taja _____
018	**What is your highest level of education?** Kiwango cha juu cha elimu?	☐ 1 – No formal education/ Hakusoma ☐ 2 –Started primary school but did not complete/ Hakumaliza shule ya msingi ☐ 3 – Completed Standard 7/ Amemaliza elemu ya ☐ 4 – Started secondary school but did not complete/ Hakumaliza elemu ya sekondarimsingi ☐ 5 – Completed Form 4 / Kukamilika kidato cha 4 ☐ 6 – Completed Form 6 / Kukamilika kidato cha 6 ☐ 7 – Other, specify/ Nyingine, taja _____
019	**What type of other activities are you involved in to generate income?** *(Check all that apply – do NOT read the choices to the respondent… only check the activities that the respondent states unprompted)* Ni shughuli gani zingine unafanya kwa ajili ya kujiingizia kipato? *(angalia zote zinazohusika-usimsomee mhojiwa…angalia shughuli/kazi ambazo mhojiwa anajibu)*	☐ 0 – None specified / Hakuna ☐ 1 – Agriculture farmer / Kilimo ☐ 2 – Livestock farmer / Ufugaji ☐ 3 – Shop attendant kuuza / Duka ☐ 4 – Waitress / Mhudumu ☐ 5 – Cook / Upishi ☐ 6 – Teacher / Mwalimu ☐ 7 – Construction / Ujenzi ☐ 8 – Other, specify: Ingine
020	**Time in service being a CHW** Uzoefu wa miaka aliyofanya kazi akiwa Mhudumu wa afya majumbani	|___|___| Months / Miezi |___|___| Years / Mwaka *(if <1 year, fill in number of months)* *(kama ni chini ya mwaka mmoja, jaza idadi ya miezi)*

Section 2. Community Health Career Narrative
Sehemu ya Pili: Masimulizi/Malezo ya Kazi ya Afya ya Jamii

Next we'd like to hear about your experience in becoming a home-based care worker:
Sasa Napenda kusikia kutoka kwako juu ya uzoefu wako wa kua mfanyakazi wa afya majumbani

1. How did first get involved in health matters in your community?
   Kwanza uliwezaje kuingia kwenye masuala ya afya hapa kwenye jamii yako?

2. Have you ever received formal training in health? Please describe.
   Umewahi kupata mafunzo rasmi ya afya?

   Probes: Dodosa
   - When did you receive the training?
     Lini ulipata mafunzo?
   - What type of training have you received?
     Ni aina gani ya mafunzo ulipatiwa?
   - Who (organization or mentor) provided the training?
     Ni nani (asasi, mshauri) alitoa mafunzo hayo?
   - If participant doesn't mention HBC training, ask specifically about their experience receiving home-based care training and when they were trained…
     Endapo mshiriki hajataja mafunzo ya huduma za afya majumbani…. Uliza kuhusu uzoefu wake katika kupata mafunzo ya huduma za afya majumbani na ni lini walipatiwa mafunzo
   - What other health programs are you involved in? (volunteer or paid)
     Ni programu gani zingine za afya unazohusika nazo? (kujitolea au kulipwa)

3. Since becoming a home-based care worker, have you received any additional training on maternal, newborn and child health (MNCH)? Please describe.
   Tangu umekua mfanyakazi wa afya majumbani umeshawahi kupata mafunzo yoyote ya nyongeza juu ya mambo ya uzazi, watoto wachanga na afya ya mtoto?(MNCH)? Tafadhali elezea

   Probes: Dodosa
   - How were you selected to receive MNCH training?
     Ulichaguliwaje kwenda kupata mafunzo ya uzazi, watoto wachanga na afya ya mtoto?
   - When did you receive the training?
     Lini ulipata mafunzo?
   - Was there any material in the training that you had a hard time understanding? If so please describe.
     Je kuna vitu vyoyote katika mafunzo hayo ulipata wakati mgumu kuvielewa? Kama vipo tafadhali Elezea
   - Did the MNCH trainers provide specific examples of how to integrate HIV and MNCH activities <u>in the household? And/or in the community setting?</u> Please describe.
     Je Wakufunzi wa mafunzo ya uzazi, watoto wachanga na afya ya mtoto walitoa mifano mahususi juu ya namna gani ya kujumuisha huduma za VVU na MNCH kwenye kaya? Na/au kwenye jamii? Tafadhali elezea

Section 3. HIV and MNCH Service Delivery /
Sehemu ya Tatu: Utoaji wa huduma za UKIMWI na Huduma za uzazi, watoto wachanga na afya ya mtoto

4. Please tell me about your day-to-day activities in providing home-based care HIV services.
   Tafadhali nieleze kuhusiana na shughuli zako za kila siku za kutoa huduma za afya ya UKIMWI majumbani
   Probes: Dodosa
   - How many HIV clients do you serve in your catchment area?
     Ni wateja wangapi wenye virusi vya UKIMWI unawahudumia kwenye eneo lako?

   - What type of tasks or activities are you most commonly working on for HIV clients?
     Ni kazi gani unazozifanya mara kwa mara kila siku unazifanya unapofanyakazi na waathirka wa virusi wa UKIMWI?

   - How much time do you spend each day (or each week) providing services for HIV clients?
     Ni muda gani unatumia kwa kila siku(au kila wiki) katika kutoa huduma kwa wateja wenye virusi vya UKIMWI?

5. Please tell me about your day-to-day activities in providing MNCH services.
   Tafadhali nieleze kuhusiana na kazi zako za kila siku katika kutoa huduma za uzazi, watoto wachanga na afya ya mtoto (MNCH)
   Probes: Dodosa
   - How many MNCH clients do you serve in your catchment area?
     Ni wateja wangapi wa uzazi, watoto wachanga na afya ya mtoto (MNCH) unawahudumia kwenye eneo lako?

   - What type of tasks or activities are you most commonly working on for MNCH clients?
     Ni aina gani ya kazi /shughuli ambazo unazifanya mara kwa mara na wateja wa MNCH?

   - How much time do you spend each day (or each week) providing services for MNCH clients?
     Ni muda gani unatumia kwa kila siku(au kila wiki) kwa kutoa huduma kwa wateja wa MNCH?

Section 4. Task Prioritization / Workload Balance
Sehemu ya Nne: vipaumbele vya majukumu/ uwiano wa kazi

Now we'd like to hear about your experiences working on both HIV and MNCH activities in your community. Sasa napenda kufahamu juu ya uzoefu wako wa kufanya kazi zote mbili za VVU na MNCH katika jamii yako

6. Regarding client load: how has the catchment size (& number of households) changed since MNCH tasks were added to your CHW role?
   Kwa kuzingatia matakwa ya wateja: ni namna gani idadi ya kaya limebadilika tangu ulivyoongezewa majukumu ya MNCH kwenye majukumu yako ya mhudumu wa afya ya jamii?
   Probes: Dodosa
   - Overall number of households covered per HBC-MNCH <u>for HIV services</u>?
     Jumla ya idadi ya kaya zinahudumiwa huduma za UKIMWI na HBC-MNCH?

   - Overall number of households covered per HBC-MNCH <u>for MNCH services</u>?
     Jumla ya idadi ya kaya zinahudumiwa huduma za uzazi, watoto wachanga na afya ya mtoto na HBC-MNCH?

   - Expected number of household visits per week?
     Idadi ya kaya zinazotarajiwa kutembelewa kwa wiki?

7. What has your experience been like working on HIV and MNCH at the same time?
   Uzoefu wako umekuaje baada ya kufanya kazi huduma za VVU na MNCH kwa pamoja?

   Probes: Dodosa
   - So far, how have you managed the additional catchment size?
     Mpaka sasa ni ki vipi umeweza kumudu ongezeko la idadi ya kaya katika eneo lako la kazi?

   - How does the change in catchment size impact how you organize your services?
     Ni kwa namna gani mabadiliko ya ukubwa wa eneo yanaathiri mpangilio wako wa kutoa huduma?
   - How has the number of hours worked per week changed?
     Ki vipi saa za kazi zimebadilika kwa wiki?

8. What factors influence your ability to combine HIV and MNCH services?
   Vitu gani vinaathiri uwezo wako wa kujumuisha huduma za VVU na MNCH?

9. How have your community health activities changed since receiving additional training on MNCH?
   Kwa vipi shughuli zako za afya ya jamii zimebadilika tangu ulivyopokea mafunzo ya nyongeza ya MNCH?

   Probes: Dodosa
   - Can you share examples of specific activities that have changed?
     Unaweza kutoa mfano mahususi wa shughuli iliyobadilika?

10. How do you decide which activities (HIV, MNCH, or both) to work on during a particular day?
    Unaamua vipi kuhusu kazi ipi (UKIMWI, uzazi, watoto wachanga na afya ya mtoto au zote) ya kufanya kwa siku husika?

    Probes: dodosa
    - Have you had to prioritize certain activities? Please describe.
      Je! Hua unatoa kipaumbele kwa kazi Fulani? Tafadhali elezea

11. Have you been able to continue tracking defaulter HIV patients and providing adherence support in the same way as before you were trained on MNCH? Please describe what has changed, if anything.
    Umeweza kuendelea kufuatilia wagonjwa wa ukimwi na kuwapatia msaada ule ule kama ilivyokua awali kabla hujapata mafunzo ya uzazi, watoto wachanga na afya ya mtoto? Tafadhali elezea nini kimebadilika kama kipo?

12. Data collection: How has the data collection workload changed?
    Ukusanyaji wa Taarifa: Ni kwa namna gani kazi ya ukusanyaji wa taarifa imebadilika?

    Probes: Dodosa
    - Did the trainers provide guidance on how to track new monthly MNCH indicators and report them to the facility?
      Je wakufunzi walitoa mwongozo jinsi ya kufuatilia viashiria vipya vya MNCH na kuzitolea taarifa kwenye kituo cha afya?

Section 5: HBC-MNCH Work Satisfaction Sehemu ya Tano: Kuridhishwa na kazi ya Mhudumu wa afya ya majumbani wa Huduma za uzazi, watoto wachanga na afya ya watoto

Now we'd like to ask about your satisfaction with combining HIV and MNCH services.
Napenda kukuuliza juu ya kuridhishwa kwako kwa kuchanganya huduma za UKIMWI na hizi za uzazi, watoto wachanga na afya ya watoto

13. How satisfied are you with adding MNCH tasks to your role as a HBC CHW?
Ukiwa kama Mhudumu wa afya majubani, ni kwa namna gani unaridhishwa kwa kuongezewa majukumu ya uzazi, watoto wachanga na afya ya watoto?

    Probes: Dodosa
    - Would you rather have remained focused only on one health area (either HIV or MNCH)? Why or why not?
      Ni vyema ungebakiwa na eneo moja tu la kutoa huduma za afya (UKIMWI au MNCH) kwa nini? Kwa nini Hapana?

    - NOTE: if say only focus on one – which one: HIV or MNCH?
      Kumbuka: kama ndiyo ni ipi (HBC au MNCH)

14. In your opinion, what are the main highlights (successes) of the combined HBC-MNCH program?
Kwa maoni yako kuna mafanikio gani ya kuchanganya programu ya HBC-MNCH?

15. In your opinion, what are the main challenges of the combined HBC-MNCH program?
Kwa maoni yako kuna changamoto gani zitokanazo na kuchanganya programu za HBC na MNCH?

    Probes: Dodosa
    - What challenges have you faced in performing the new MNCH tasks on top of your original HIV responsibilities?
      Changamoto zipi ulizokutana nazo wakati wa kutekeleza majukumu mapya ya huduma za uzazi, watoto wachanga na afya ya watoto (MNCH) juu ya majukumu yako ya awali ya Ukimwi?

    - Do you have enough time to work on tasks for HIV and tasks for MNCH?
      Je, una muda wa kutosha wa kufanya kazi za Ukimwi na zile za MNCH?

Section 6. Supervision / Sehemu ya Sita: Usimamizi

16. Please describe what kind of supervision support you receive for home-based care by a supervisor from your nearby dispensary or health center.
Tafadhali elezea, ni aina gani ya usimamizi unaupata kutoka kwa msimamizi wa zahanati au kituo cha afya kilicho karibu yako

    Probes: Dodosa
    - What do you discuss?
      Mnajadili nini?

    - How often are you supervised by someone from the facility?
      Ni mara ngapi unasimamiwa na mtu kutoka kituo cha afya?

    - Where are you supervised? (Community/household level? Facility-based?)
      Unasimamiwa wapi? (kwenye jamii/ngazi ya kaya? Kituoni?)

    - What is the focus of the supervision?
      Usimamizi huo unalenga nini?

    - How does the supervision affect your work?
      Nini matokeo ya usimamizi wa kazi yako?

    - How do you feel after supervision?
      Unajisikiaje baada ya kusimamiwa?

17. Please describe what kind of supervision support you receive for home-based care by a supervisor from the civil society organization (Afya Women Group or Iringa Mercy Organization).
Tafadhali elezea, ni aina gani ya msaada wa kiusimamizi unaupata kwa wasimamizi wa asasi za kiraia (kikundi cha afya cha wanawake au asasi ya huruma ya Iringa) kwa ajili ya huduma za afya majumbani

    Probes: Dodosa
    - What do you discuss?
      Mnajadili nini?

    - How often are you supervised by someone from the CSO?
      Ni mara ngapi unasimamiwa na mtu kutoka asasi ya kiraia?

    - Where are you supervised? (Community/household level? Facility-based? CSO-based?)
      Usimamizi huo unafanyika wapi? (kwenye jamii/ngazi ya kaya? Kituoni? Asasi za kiraia?)

    - What is the focus of the supervision?
      Usimamizi huo unalenga nini?

    - How does the supervision affect your work?
      Ni nini matokeo ya usimamizi huo?

    - How do you feel after supervision?
      Unajisikiaje baada ya kusimamiwa?

18. Does the supervisor go over your monthly household data with you?
Je wewe na msimamizi mnapitia kwa pamoja taarifa za mwezi za kwenye kaya?

    Probes: Dodosa
    - What these meetings are like?
      Mikutano hii inakuaje?

    - If you don't review household level data with the supervisor, why not?
      Kama hampitii kwa pamoja na msimamizi taarifa za ngazi ya kaya, Kwa nini?

Section 7. Program Acceptability / Sehemu ya Saba: Kukubalika kwa programu

19. How was information that HBCs would provide MNCH services communicated to the community?
Ni kwa jinsi taarifa zakuwa HBC wameaanza kutoa huduma za MNCH ziliwafika wanajamii?

20. How have community beneficiaries responded to the HBC-MNCH CHW program?
Ni kwa namna gani walengwa wameitikia juu ya huduma jumuishi ya HBC-MNCH CHW?
Probes: Dodosa
    - Why do you think they like (or dislike) that HBCs are now providing MNCH services at the household level?
      Kwa nini unafikiri wamependa (au hawajapenda) wahudumu wa afya majumbani ambao kwa sasa wanatoa huduma za MNCH katika ngazi ya jamii?

21. How have supervisors responded to the HBC-MNCH CHW program?
Je! Nini mwitikio wa wasimamizi dhidi ya grogramu ya HBC-MNCH CHW?

    Probes: Dodosa
    - Why do you think they like (or dislike) that HBCs are now providing MNCH services at the household level?
      Kwa nini unafikiri wanapenda (au hawapendi) wahudumu wa afya majumbani kutoa huduma za MNCH katika ngazi ya jamii?

Section 8. Recommendations / Sehemu ya Nane: Mapendekezo

22. What changes to the HBC-MNCH model model would you make to improve the program? Please describe.
    Ni mabadiliko gani unaweza kupendekeza kwa ajili ya kuboresha muundo wa programu ya HBC-MNCH? Tafadhali Elezea

23. Would you recommend the integrated HBC-MNCH model be adopted by all HBCs in this district?... Why or why not?
    Je unapendekeza muundo jumuishi wa HBC-MNCH uhusishe wahudumu wote wa afya majumbani katika wilaya hii? Kwa nini/ kwa nini Hapana?

Appendix 2. *Final codebook for qualitative data analysis*

#	Numeric "brief" code	Full description of code	When to use and when not use the code
	1.0 BACKGROUND	Personal background, including experiences and education.	Use 1.0 grouping of codes according to parameters listed under 1.1-1.4.
1	1.1 EDUCATION	Education level	Use this code when participants provide details around their educational history and level.
2	1.2 CHW EXPERIENCE	Experience that led to involvement in community health volunteerism	HBCs were asked about how they first got involved with community-related work – use this code when HBC participants describe their experiences that led to becoming involved in community health work, or explain the process by which they decided to work as HBCs. Note: this code is different from the nomination/selection process (See codes 2.2 & 2.4).
3	1.3 YEARS	Length of time working for HBC program	Use this code when participants state how long they have been involved with the program – specify using the four sub-codes below whether HBC, supervisor, CSO, Deloitte.
4	1.4 PROGRAM HISTORY	References to history of the HBC program in Iringa	Use this code when participants discuss the history of the HBC program in Iringa Region; this includes reference to the original mission of regional implementing partner and history of the CSO involvement.
	2.0 CHW TRAINING	Selection and training for HBC, MNCH, and other trainings	Use 2.0 grouping of codes according to parameters listed under 2.1-2.5.
5	2.1 HBC SELECTION	Selection process to receive HBC training	Use this code when participants describe how individuals were selected to receive the HBC training, i.e. the nomination/selection process to receive such training.
6	2.2 HBC TRAINING	Details of HBC training	Use this code when participants provide details related to HBC training (HIV-focused) … this might include when the training occurred, the duration of training, the type of training, and who provided the training etc. Note – MNCH-specific selection (2.3), training (2.4) and other types of training (2.5) have separate codes described below.
7	2.3 MNCH SELECTION	Selection process for HBCs to receive MNCH training	Use this code when participants describe how HBCs were s to receive additional training on MNCH (from the regional implementing partner), i.e. the nomination process to get selected for such MNCH training.
8	2.4 MNCH TRAINING	Details of MNCH training for existing HBCs	This code is specific to participant descriptions of MNCH training, as part of the integration efforts – again, it may include when the training occurred, the duration of training, and who provided the training.

#	Numeric "brief" code	Full description of code	When to use and when not use the code
9	2.4.1 TRAINING INTEGRATION	Training elements that addressed integration issues.	Use this code when participants discuss what the training included about how to (or why to) integrate HIV/MNCH services.
10	2.5 OTHER TRAINING	Details of any other type of health training received by HBCs	Use this code when participants describe any other formal training in health they received; this code should be used for additional trainings (outside of the HBC/MNCH program), recognizing that CHWs often volunteer across multiple organizations
	3.0 SERVICE DELIVERY	Description of HBC tasks, HIV and MNCH-related	Use 3.0 grouping of codes according to parameters listed under 3.1-3.8.
11	3.1 HIV-RELATED TASKS	HIV-related tasks performed by HBCs	Use this code when participants describe the day-to-day activities most commonly carried out by HBCs in providing home- and community-based HIV services.
12	3.2 NUMBER HIV CLIENTS	Estimate of HIV-client load	Use this code when participants provide estimates of the number of HIV clients served.
13	3.3 HIV TIME SPENT	Estimate of time spent on HIV-related tasks	Use this code when participants provide estimates of how much time they spend each day (or each week) providing services for HIV clients –OR- if they discuss how many clients visited per day/week/month. If the passage refers to both types of clients, then cross-code with MNCH-time spent.
14	3.4 CHALLENGES HIV	Challenges faced by HBCs in conducting HIV activities	Use this code when participants discuss challenges faced by HBCs that are specific to conducting HIV-related tasks. Also, includes negative experiences/attitudes towards the HIV component of HBC job. Note: Separate code for integration challenges (4.7).
15	3.5 MNCH-RELATED TASKS	Description of MNCH-related tasks performed by HBCs	Use this code when participants describe the day-to-day activities most commonly carried out by HBCs in providing home- and community-based MNCH services.
16	3.6 NUMBER MNCH CLIENTS	Estimate of MNCH-client load	Use this code when participants provide estimates of the number of MNCH clients served.
17	3.7 MNCH TIME SPENT	Estimate of time spent on MNCH-related tasks	Use this code when participants provide estimates of how much time they spend each day (or each week) providing services for MNCH clients –OR- if they discuss how many clients visited per day/week/month. If the passage refers to both types of clients, then cross-code with HIV-time spent.
18	3.8 CHALLENGES-MNCH	Challenges faced by HBCs in conducting MNCH activities	Use this code when participants discuss challenges faced by HBCs that are specific to conducting MNCH-related tasks. Also, includes negative experiences/attitudes towards the MNCH components of HBC job. Note: Other code for integration challenges (4.7).
19	3.9 DATA MONITORING	HBC data monitoring activities	Use this code when participants describe processes related to data monitoring/tracking/reporting.

#	Numeric "brief" code	Full description of code	When to use and when not use the code
	4.0 ROLE EXPANSION	Changes after role expands to include MNCH activities	Use 4.0 grouping of codes according to parameters listed under 4.1-4.10.
20	4.1 TASK PLANNING	Planning for organization of tasks, post HIV-MNCH integration	Use this code when participants describe how the integrated HBC-MNCH CHWs plan tasks for two scopes of work, including strategies to ensure both activities are covered and descriptions of how planning or organization of tasks may have changed post-integration.
21	4.1.1 PRIORITIZATION	Task prioritization	Use this code when participants describe whether tasks are prioritized in any manner. This is a sub-code within task planning, since prioritization is an element of planning.
22	4.2 TASK GUIDANCE	Guidance on structuring tasks/activities, post HIV-MNCH integration	Use this code when participants describe any guidance received from supervisors, CSOs, Deloitte, clients, or community members about how to structure or organize delivery of both HIV and MNCH tasks. This includes whether supervision/oversight helped to guide the HBCs toward prioritization of certain tasks or activities.
23	4.3 TASK INTEGRATION	Integration of HIV and MNCH tasks	Use this code when participants describe specific HIV and MNCH services that they combine at <u>one</u> point of service delivery (either household visits or community events).
24	4.4 CATCHMENT CHANGE	Change in catchment or coverage area, post HIV-MNCH integration	Use this code when participants describe how their catchment area or coverage area, i.e. the number of households they are responsible for visiting, may have changed (or stayed the same) after HIV-MNCH integration.
25	4.5 WORKLOAD TIME	Change in time providing services, post integration	Use this code when participants describe any changes to the amount of time spent providing community health services after HIV-MNCH integration.
26	4.6 HIV ROLE MAINTENANCE	Maintenance of HIV responsibilities following HIV-MNCH integration	Use this code when participants describe how HBCs are able to maintain their original HIV activities and responsibilities (such as loss-to-follow-up tracking for patients that fall out of care and treatment) after HIV-MNCH integration. This includes reference to any factors that contribute to successfully "balancing" both sets of tasks.
27	4.7 CHALLENGES-INTEGRATION	Challenges of integrating HIV and MNCH scopes of work	Use this code when participants discuss specific challenges to integrating the two scopes of work, HIV and MNCH.
28	4.7.1 DATA REPORTS	Challenges related to data reporting requirements	Use this code when participants describe challenges related to reporting requirements for HIV and MNCH.
29	4.7.2 STIPEND /ALLOWANCE	Challenges related to level of stipend/compensation	Use this code when participants describe the stipend allowance level as a challenge (too low) with regard to the high level of workload/role expectations in integrated model.

#	Numeric "brief" code	Full description of code	When to use and when not use the code
30	4.8 ADVANTAGES-CLIENT	Advantages to clients of integrating HIV and MNCH	Use this code when participants discuss the relative advantages of integration to clients – this includes benefits to the clients of integrating the two scopes of work, plus any reasons why they believe the integration was a good idea from the perspective of clients, or why they perceive that clients think the integrated model is advantageous.
31	4.9 DISADVANTAGES-CLIENT	Disadvantages to clients of integrating HIV and MNCH	Use this code when participants discuss any disadvantages to the clients of integration of HIV and MNCH services. This includes reasons why they believe the integration was NOT advantageous to clients.
32	4.10 ADVANTAGES-HBC	Advantages to HBCs of integrating HIV and MNCH scopes of work	Use this code when participants discuss the relative advantages of integration to the HBCs – this includes perceptions about why the integration was a good idea for HBCs personally (i.e. how they benefited → gained more knowledge and skills, became a more important person in the community); also, includes positive attitudes towards integration, plus any reasons why it is perceived to be better than the previous HIV-focused model.
	5.0 SUPERVISION	Description of supervision	Use 5.0 grouping of codes according to parameters listed under 5.1-5.3.
33	5.1 SUPERVISION-HIV	HIV supervisor's job title, duties/responsibilities and role	Use this code for descriptions of facility-based HIV supervisor's job title, duties/responsibilities and role
34	5.1.1 SUPR-FREQ-HIV	Frequency of HIV supervision	Use this code for descriptions of how often HBCs meet with their supervisor to discuss HIV issues.
35	5.1.2 SUPR-OUTCOMES-HIV	Outcomes/results of HIV supervision	Use this code for descriptions of what results from the HIV supervision visits, i.e. how the HBCs feel after supervision, and examples of what changed or was improved by supervision
36	5.1.3 SUPR-LOCATION-HIV		Descriptions of where the HIV supervision and meetings occur.
37	5.1.4 SUPR-DIVISION-HIV		Use this code when supervisors discuss whether they supervise HBCs on HIV-only or both HIV and MNCH… and why or why not.
38	5.1.5 SUPR-CHALLENGES-HIV	Challenges of facility-based supervision for HIV	Use this code for descriptions of challenges associated with HBC supervision conducted by HIV facility-based supervisors.
39	5.2 SUPERVISION-MNCH	MNCH supervisor's job title, duties/responsibilities and role	Use this code for descriptions of facility-based MNCH supervisor's job title, duties/responsibilities and role

#	Numeric "brief" code	Full description of code	When to use and when not use the code
40	5.2.1 SUPR-FREQ-MNCH	Frequency of MNCH supervision	Use this code for descriptions of how often HBCs meet with their supervisor to discuss MNCH issues.
41	5.2.2 SUPR-OUTCOMES-MNCH	Outcomes/results of MNCH supervision	Use this code for descriptions of what results from the MNCH supervision visits, i.e. how the HBCs feel after supervision, and examples of what changed or was improved by supervision.
42	5.2.3 SUPR-LOCATION-MNCH		Descriptions of where the MNCH supervision and meetings occur.
43	5.2.4 SUPR-DIVISION-MNCH		Use this code when supervisors discuss whether they supervise HBCs on MNCH-only or both MNCH and HIV… and why or why not.
44	5.2.5 SUPR-CHALLENGES-MNCH	Challenges of facility-based supervision for MNCH	Use this code for descriptions of challenges associated with HBC supervision conducted by MNCH facility-based supervisors.
45	5.3 SUPERVISION-CSO	CSO supervisor's job title, role, duties/responsibilities	Use this code for descriptions of CSO-based supervisor ("HBC focal person") job title, duties/responsibilities and role.
46	5.3.1 SUPR-FREQ-CSO	Frequency of CSO supervision	Use this code for descriptions of how often HBCs meet with the CSO focal persons/ supervisor.
47	5.3.2 SUPR-OUTCOMES-CSO	Outcomes/results of CSO supervision meetings.	Use this code for descriptions of what results from the meetings with CSO focal persons/ supervisors, i.e. how the HBCs feel after supervision, and examples of what changed or was improved after meetings with the CSO.
48	5.3.3 SUPR-LOCATION-CSO	Location of CSO supervision meetings	Descriptions of where the CSO supervision and meetings occur.
49	5.3.4 SUPR-CHALLENGES-CSO	Challenges of CSO-based supervision	Use this code for descriptions of challenges associated with HBC supervision conducted by the CSO-based supervisors ("HBC focal persons")
	6.0 ACCEPTANCE /ADOPTION	Perception among stakeholders that an intervention is agreeable	Use 6.0 grouping of codes according to parameters listed under 6.1-6.6.
50	6.1 ACCEPTANCE-COMMUNITY	Community acceptance of integrated model	Use this code when participants describe the community response to the integrated HIV-MNCH model; also, referred to as "acceptability, comfort, relative advantage, or credibility". Could be positive OR negative views on acceptance of the integration.

#	Numeric "brief" code	Full description of code	When to use and when not use the code
51	6.1.1 COMMUNITY INTRODUCTION	Introduction of integrated model to the community	Use this code when participants describe how their new integrated role was introduced to the community
52	6.1.2 DECREASE STIGMA	Discussion of issues of stigma related to HBC program	Use this code when participants discuss how the combination of HIV and MNCH by one CHW has reduced stigma associated with being visited by an HBC that was formerly only focused on HIV-related services
53	6.2 ACCEPTANCE-SUPERVISORS	Supervisor acceptance of integrated model	Use this code when participants describe the supervisors' response to the integrated HIV-MNCH model.
54	6.3 ACCEPTANCE-HBC	HBC acceptance of integrated model	Use this code when participants describe the HBCs response to the integrated HIV-MNCH model.
55	6.3.1 HBC WORK SATISFACTION	Satisfaction with HBC job	Use this code when HBCs describe their satisfaction/fulfilment/contentment with their role.
56	6.3.2 ONE vs. TWO ROLES	Perspectives on number of roles HBCs should have	Use this code when participants discuss whether they think the HBCs should have one role (either HIV *or* MNCH) or both roles (HIV *and* MNCH)
57	6.4 ACCEPTANCE-CSOs	CSO staff acceptance of integrated model	Use this code when participants describe the CSOs' response to the integrated HIV-MNCH model.
58	6.5 RECS	Suggested improvements to the integrated HIV-MNCH model	Use this code for descriptions of recommended changes to improve the integrated HIV-MNCH model going forward.
59	6.5.1 REC-ALLOWANCE		Recommended improvements related to the stipend amount
60	6.5.2 REC-TRANSPORT		Recommended improvements related to how HBCs move around with transportation, bicycles etc.
61	6.5.3 REC-CONTENT		Recommended improvements related to the content of what HBCs cover in their health education/promotion roles.
62	6.5.4 REC-REFRESSHER		Recommended improvements related to provision of refresher trainings.
63	6.5.5 REC-EDUCATION FLIERS		Recommended improvements related to provision of educational materials to distribute in the community.
64	6.5.6 REC-CHW: POP RATIO		Use this code when participants make recommendations related to the catchment size that HBCs should cover

#	Numeric "brief" code	Full description of code	When to use and when not use the code
65	6.5.7 REC-EQUIPMENT		Use this code when participants make recommendations related to equipment needs of the HBCs
66	6.5.8 REC-SUPERVISION		Use this code when participants make recommendations related to supervision of HBCs
67	6.6 ADOPTION	Recommendations on wider adoption of HIV-MNCH model.	Adoption is defined as the "the intention, initial decision, or action to try to employ a new intervention"; also, referred to as uptake, utilization, or intention to try – use this code when participants explain perspectives on whether the integrated HIV-MNCH model should be adopted throughout all of Iringa region.
68	6.7 BENEFITS – HBC PROGRAM	General benefits of HBC program	Use this code to describe general benefits of the HBC program, i.e. HIV-related (this code should NOT be used for benefits of integrated model).
69	**7.0 MISCELLANEOUS**	Miscellaneous text.	Use this code for any important passages that do not fit among the other codes.
70	**8.0 QUOTES**	Good quotes.	Use this code for illustrative quotes; cross-code with the underlying theme above.

Appendix 3. CHW Demographic and Background Survey

Muhimbili University of Health and Allied Sciences (MUHAS) / Johns Hopkins Bloomberg School of Public Health, Funded by USAID
A Learning Agenda for the Development of Community Based Programs in Tanzania - Toward the Development of a Community Health Worker Cadre
JHSPH IRB: 00005497 / Version Date: October 18, 2015

Introduction
We are coming from Muhimbili University in Dar es Salaam and are working in collaboration with Johns Hopkins School of Public Health in the United States. We are conducting a study to assist the Ministry of Health and Social Welfare (MOHSW) and the National Community Health Worker (CHW) Task Force to understand community health worker (CHW) perspectives on role expansion, workload, and productivity among volunteer CHWs.

You have been selected to participate in this interview because of your experience working as a Home-Based Care (HBC) worker in Iringa Region under the Tunajali program. We are requesting you to participate by providing answers to a small set of questions about your background. Information from these interviews will help us understand more about the characteristics of home-based care CHWs.

The information you provide during this interview will be analyzed by our research team and will be represented in the form of documents to be presented to the Ministry of Health and Social Welfare and its National CHW Task Force.

All interview content will be completely anonymous. Your name will not be recorded or attached to your responses. If at any point of this interview you wish to skip a question or you no longer wish to proceed, please feel free to let us know so that we may stop the interview process. There will be no consequence to you if you do not wish to participate.

Are you interested to participate in the study? ***If yes, please administer verbal consent form.***

Utangulizi
Tunatokea chuo kikuu cha Muhimbili kilichopo Dar es Salaam tukishirikiana na chuo kikuu cha Johns Hopkins School of Public Health kilichopo marekani. Tunafanya utafiti kwa ajili ya kuisaidia Wizara ya Afya Maendeleo ya Jamii, Jinsia, Wazee na Watoto, pamoja na kikosi kazi cha wahudumu wa afya ya jamii ili kuweza kuelewa mitazamo ya wahudumu wa afya ya jamii katika kuongeza wigo wa majukumu yao na tija miongoni kwa wahudumu wa kujitolea wa Afya ya Jamii.

Umechaguliwa kushiriki katika utafiti huu kwa sababu ya uzoefu wako wa kufanya kazi kama mfanyakazi wa Huduma za Majumbani kwenye mkoa wa Iringa chini ya programu ya Tunajali. Tunakuomba ushiriki kwa kutoa majibu ya maswali mafupi juu ya historia yako. Taarifa zitakazotokana na mahojiano haya zinatusaidia sisi kuelewa zaidi kuhusu sifa za mhudumu wa afya wa majumbani HBCs.

Taarifa utakazozitoa kipindi cha mahojiano haya zitafanyiwa uchambuzi na timu ya watafiti wetu na zitawasilishwa wizara ya afya na ustawi wa jamii na kikosi kazi chake zikiwa kwenye mfumo wa hati/-kabrasha.

Mahojiano yote yatakua ni ya siri. Jina lako halitanakiliwa wala kuambatanishwa kwenye majibu yako. Na wakati wowote ukijisikia hupendi kujibu swali Fulani au huwezi tena kuendelea na mahojiano, tafadhali jisikie huru kutuambia ili tuweze kusitisha mchakato huu wa mahojiano. Hakuna athari yoyote utakayoipata endapo ukiamua kujiondoa kwenye mahojiano haya.

Upo tayari kushiriki kwenye utafiti huu? Kama jibu ni NDIYO endelea na mchakato wa fomu ya ridhaa ya m domo.

Section I. Background Questions / Sehemu ya I: Maswali ya utangulizi

No.	A. Interview details	
000	**HBC Unique ID**	|___|___|___|___|___|___|___|___|
001	**Date of Interview** Tarehe ya majadiliano	Day/ Siku: |___|___|
		Month/ Mwezi:|___|___|
		Year/ Mwaka: |___|___|___|___|
002	**Time of interview** Muda wa mahojiano (masaa 24)	|___|___| : |___|___|
No.	**B. CHW Demographics**	
003	**Age** Umri	|___|___| Years / Mwaka
004	**Sex** Jinsi	☐ 1 – Male/ Mwanamume ☐ 2 – Female/ Mwanamke
005	**What is your highest level of education?** Kiwango chako cha juu cha elimu?	☐ 1 –No formal education / Hakusoma ☐ 2 –Started primary school but did not complete / Hakumaliza shule yamsingi ☐ 3 –Completed Standard 7 / Amemaliza elemu ya msingi ☐ 4 –Started secondary school but did not complete / Hakumaliza elemu ya sekondari ☐ 5 –Completed Form 4 / Amemaliza kidato cha 4 ☐ 6 –Completed Form 6 / Amemaliza kidato cha 6 ☐ 7 –Other, specify / Nyingine, taja _____
006	**Marital Status** Hali ya ndoa	☐ 1 – Married / Kaoa/ olewa ☐ 2 – Single / Mseja ☐ 3 – Cohabitating, but unmarried / Anaishi na mwenza ☐ 4 – Widowed/widower / Mjane/mgane ☐ 5 – Divorced / kaachika/tengana
007	**Religion** Dini	☐ 1 – Christian / Mkristo ☐ 2 – Muslim / Muislamu ☐ 3 – Indigenous beliefs / Imani asili ☐ 4 – Other, specify / Nyingine, taja _____
008	**Number of dependents** Idadi ya wategemezi	|___|___|
010	**Number years of experience working as an HBC** (if <1 year, fill in number of months) Uzoefu wa miaka aliyofanya kazi akiwa Mhudumu wa afya majumbani (kama ni chini ya mwaka mmoja, jaza idadi ya miezi)	|___|___| Months / Miezi |___|___| Years / Mwaka

011	**Have you received training on MNCH from the Tunajali program?** Je umepata mafunzo juu ya huduma ya afya ya uzazi, afya ya watoto wachanga na afya ya mtoto?	☐ 0 – No / Hapana ☐ 1 – Yes / Ndio
012	**Do you currently work for other CHW programs, beyond HBC or HBC-MNCH?** Kwa sasa kuna kazi zozote unafanya kwenye programu za CHW, Nje ya kuwa Mhudumu wa afya Majumbani?	☐ 0 – No / Hapana ☐ 1 – Yes / Ndio
013	If yes to 012, specify information about other types of CHW programs that you work or volunteer for: Kama ni NDIYO kwenye 012, Taja taarifa zinazohusu programu hiyo ya mhudumu wa afya ya jamii ambayo unafanya kwa kujitolea	
014	**What type of other activities are you involved in to generate income?** *(Check all that apply – do NOT read the choices to the respondent… only check the activities that the respondent states unprompted)* Ni shughuli gani zingine unafanya kwa ajili ya kujiingizia kipato? (*angalia zote zinazohusika- usimsomee mhojiwa…angalia shughuli/kazi ambazo mhojiwa anajibu)*	☐ 0 – None specified / Hakuna ☐ 1 – Agriculture farmer / Kilimo ☐ 2 – Livestock farmer / Ufugaji ☐ 3 – Shop attendant / Kuuza Duka ☐ 4 – Waitress / Mhudumu ☐ 5 – Cook / Upishi ☐ 6 – Teacher / Mwalimu ☐ 7 – Construction / Ujenzi ☐ 8 – Other, specify: Nyingine, taja _____
015	**Monthly household income from all sources:** Kipato cha mwezi cha kaya kutoka kwenye vyanzo vyote vya mapato	|___|___|___|___|___|___|___|___| Tanzanian Shillings Shilingi za Kitanzania
No.	**C. HBC Program Characteristics** C. Sifa za Programu ya wahudumu wa Afya Majumbani	
016	**Approximately how many HIV clients do you serve as part of the HBC program?** Kwa kukadiria ni wateja wangapi wenye virusi vya Ukimwi unaowahudumia ikiwa ni sehemu ya programu ya wahudumu wa afya majumbani	|___|___| HIV Clients wateja wa Ukimwi
017	**Skip: if HBC has not been trained on MNCH by Tunajali (Q11)**	|___|___| Households

	Approximately how many households do you serve with MNCH services as part of the HBC program? Kwa kukadiria ni wateja wangapi kwenye kaya unaowahudumia ikiwa ni sehemu ya programu ya wahudumu wa afya uzazi, afya ya watoto wachanga na afya ya mtoto?	
018	**Location in Iringa where you live?** Hapa Iringa Unaishi wapi?	Name of Village/ Kijiji:
019		Name of Ward/ Kata:
020		Name of District Council/ Wilaya:
021	**Which CSO supports your work?** Ni asasi gani gani ya Kijamii inasaidia kazi zako?	☐ 1 – AWG ☐ 2 – IMO
No.	**D. Facility Information**	
022	**Name of nearest health facility that supervises you?** Kituo cha kutolea huduma za afya unapopeleka taarifa	
023	**Health Facility Type (of nearest supervising health facility)** Aina ya kituo (kituo cha afya unapopeleka taarifa)	☐ 1 – Dispensary / Zahanati ☐ 2 – Health center / Kituo cha afya ☐ 3 – District hospital / Hospitaliyawilaya ☐ 4 – Regional hospital / Hospitaliyamkoa ☐ 5 – Other, specify / Nyingine, taja:_____
024	**Distance from your home village to the health facility that you report to?** Kuna umbali gani kutoka kijijini kwako mpaka kituo cha afya unapopeleka taarifa	|___|___| Kilometers / kilometa
025	**Is your supervising facility government run, faith based, or private?** Je kituo chako cha usimamizi ni cha serikali, cha dini au cha binafsi?	☐ 1 – Government / Serikali ☐ 2 – Faith-based / Dini ☐ 3 – Private / Binafsi
026	**Most common mode of travel from home to the health facility that you report to?** Aina ya usafiri unaotumia kutoka nyumbani hadi kituo cha afya unapopeleka taarifa?	☐ 1 – On foot / Kwa miguu ☐ 2 – Bicycle / Baiskeli ☐ 3 – Motorcycle / Pikipiki ☐ 4 – Public bus / Daladala ☐ 5 – Other, specify: / Nyingine, taja: _____
027	**Average time from home to health facility that supports you (if less than 1 hour, report minutes only)**	|___|___| hours |___|___| Minutes / Dakika

	Muda kutoka nyumbani hadi kituo cha kutolea huduma za afya unapopeleka taarifa (kwa dakika)	
028	**Most common mode of travel from home to household visits?** / Aina ya usafiri unaotumia kutoka nyumbani hadi kituo cha afya unapopeleka taarifa?	☐ 1 – On foot / Kwa miguu ☐ 2 – Bicycle / Baiskeli ☐ 3 – Motorcycle / Pikipiki ☐ 4 – Public bus / Daladala ☐ 5 – Other, specify: /Nyingine, taja:_____
029	**Did you receive a bicycle from the HBC program?** Umepokea baiskeli kutoka kwenye programu ya wahudumu wa afya majumbani?	☐ 0 – No / Hapana ☐ 1 – Yes / Ndiyo
030	**Name of nearest ART center to where you live? [*Could be same as the nearest facility you report to for supervision*]** Jina la kituo cha karibu cha ART kutoka unapoishi? (ni sawa na kituo cha karibu cha usimamizi?)	
031	**Distance from the facility where you report to the district hospital?** Umbali kutoka kituo cha usimamizi kwenda kwenye hospitali Wilaya	|___|___| Kilometers / Kilomita

Appendix 4. *Electronic mobile data entry forms*

(A) HIV Service Delivery

No.	Question	Result	Skip
SECTION 1: COVER PAGE			
01a	**HBC ID number** Select based on matching to HBC name	☐☐☐☐☐☐☐☐	
01b	**Date of data entry** [Automatically filled in by tablet device]	**DAY** ☐☐ **MONTH** ☐☐ **YEAR** ☐☐	
01c	**Interviewer Number**	☐☐	
SECTION 2: SUMMARY FORM MONTH AND YEAR OF SERVICE DELIVERY For each HBC-CHW, we will extract data from a monthly summary sheet on client HIV status, age, and sex for the month and year of service delivery. (Note: Depending on client load, there may be multiple pages of data per month/year of service for an individual HBC-CHW). On the next screen you will be prompted through a series of data entry questions; after the data is entered, you will be prompted to take photos of the summary data.			
02	**Month of service**	☐☐	
03	**Year of service**	☐☐☐☐	
SECTION 3: INDIVIDUAL CLIENT DATA Enter Q04, Q05, Q06 for each client listed in the monthly summary form -- 75 entries			
04	**State of HIV infection** (Hali ya maambukizi ya Ukimwi) **if no data is entered for this question, i.e. Not Applicable, it indicates individual client data entry is complete, and skips to Section 4 for photos of data sheets*	HIV-POSITIVE (Ameambukizwa).....1 HIV-NEGATIVE (Hajaambukizwa).....2 NOT KNOWN (Haijulikani).....3 MISSING .....77 NOT APPLICABLE*	➔07a
05	**Client's Age** (Umri)	☐☐	
06	**Client's Sex** (Jinsi)	MALE (Mwanamme=Me) .....1 FEMALE (Mwanamke=Ke) 2	1 2
SECTION 4: MONTHLY SUMMARY SHEET PHOTOS			
07a	Photo 1: Summary Form Page 1	TAKE PHOTO.....1 NO PHOTO (REFUSED) 9	➔08a

No.	Question	Result	Skip
07b	Photo 1, review	RETAKE PHOTO.....1 VIEW PHOTO.....2 KEEP PHOTO.....3 NO PHOTO (REFUSED).....9	
08a	Photo 2: Summary Form Page 2	TAKE PHOTO.....1 NO PHOTO (REFUSED).....9	➔09a
08b	Photo 2, review	RETAKE PHOTO..... 1 VIEW PHOTO.....2 KEEP PHOTO.....3 NO PHOTO (REFUSED).....9	
09a	Photo 3: Summary Form Page 3	TAKE PHOTO.....1 NO PHOTO (REFUSED).....9	➔10a
09b	Photo 3, review	RETAKE PHOTO.....1 VIEW PHOTO.....2 KEEP PHOTO.....3 NO PHOTO (REFUSED).....9	
10a	Photo 4: Summary Form Page 4	TAKE PHOTO.....1 NO PHOTO (REFUSED).....9	➔11a
10b	Photo 4, review	RETAKE PHOTO.....1 VIEW PHOTO.....2 KEEP PHOTO.....3 NO PHOTO (REFUSED).....9	
11a	Photo 5: Summary Form Page 5	TAKE PHOTO.....1 NO PHOTO (REFUSED).....9	➔End
11b	Photo 5, review	RETAKE PHOTO.....1 VIEW PHOTO.....2 KEEP PHOTO.....3 NO PHOTO (REFUSED).....9	

(B) MNCH Service Delivery

No.	Question	Result	Skip
SECTION 1: COVER PAGE			
01a	**HBC ID number** Select based on matching to HBC name	☐☐☐☐☐☐☐☐	
01b	**Date of data entry** Automatically filled in by tablet device	**DAY** ☐☐ **MONTH** ☐☐ **YEAR** ☐☐	
01c	**Interviewer Number**	☐☐	
SECTION 2: SUMMARY FORM MONTH AND YEAR OF SERVICE DELIVERY For each HBC CHW trained on MNCH, we will extract data from a monthly summary sheet on MNCH household visits that were conducted. On the next screen you will be prompted through a series of data entry questions; after the data is entered, you will be prompted to take a photo of the monthly summary sheet.			
02	**Month of service**	☐☐	
03	**Year of service**	☐☐☐☐	
SECTION 3: CLIENT SUMMARY DATA			
FEMALE CLIENTS			
07	**Number of new pregnant women visited this month (Line A)** Wanawake wajawazito wapya waliotembelewa mwezi huu	☐☐	
08	**Number of repeat pregnant women visited this month (Line B)** Wanawake wajawazito waliorudiwa kutembelewa mwezi huu	☐☐	
09	**Number of postnatal women visited this month (Line D)** Idadi ya wanawake waliotembelewa baada ya kujifungua mwezi huu	☐☐	
INFANT AND CHILD CLIENTS			
10	**Number of infants (less than 1 month old) visited this month (Line E)** Idadi ya watoto wachanga (Umri chini ya mwezi mmoja) waliotembelewa mwezi huu	☐☐	
11	**Number of children > 1 month to < 1 year old visited this month (Line F)** Idadi ya watoto umri kuanzia mwezi mmoja hadi mwaka mmoja waliotembelewa mwezi huu	☐☐	

No.	Question	Result	Skip
12	**Number of children >1 year to < 5 years old visited this month (Line G)** Idadi ya watoto umri kuanzia mwaka mmoja hadi miaka mitano waliotembelewa mwezi huu	☐☐	
SUMMARY MEASURES			
13	**Total number of households visited this month**	☐☐	
14	**Total number of health education meetings held this month**	☐☐	
SECTION 4: MONTHLY SUMMARY SHEET PHOTOS			
15a	Photo 1: Summary Form Page 1	TAKE PHOTO ..... 1 NO PHOTO (REFUSED)..... 9	➔ End
15b	Photo 1, review	RETAKE PHOTO ..... 1 VIEW PHOTO ..... 2 KEEP PHOTO..... 3 NO PHOTO (REFUSED)..... 9	➔ End

Appendix 5. *Supplementary statistical analyses for Chapter 2 (Manuscript 1)*

Bivariate Analysis Comparing Single and Dual Role CHWs in the Full Sample

In Manuscript 1, CHW demographics and health system characteristics were presented stratified by district because differential patterns were observed in the districts. Here we present bivariate analyses of single and dual role CHWs within the full sample, where again we note there were no statistically significant differences across groups in terms of demographic characteristics (A5. Table 1). In terms of health systems characteristics, the notable difference was that dual role CHWs were less likely to report to a dispensary-level health facility (59 vs. 88%; $p<0.001$).

A5. Table 1. Demographic and facility characteristics, comparing single and dual role CHWs.

	All CHWs n=187 (100%)	**Single Role** n=111 (59.4%)	**Dual Role** n=76 (40.6%)	
Demographic Characteristics	**Mean ± SD; or n (%)**			**p**
Age (Years)	43.2 ± 7.4	43.4 ± 7.5	43.0 ± 7.3	0.72
Dependents (Number)	5.5 ± 2.3	5.5 ± 2.3	5.4 ± 2.6	0.81
CHW experience (Years)	8.8 ± 3.6	8.9 ± 3.4	8.8 ± 3.9	0.95
Sex (Female)	100 (53.5)	62 (55.9)	38 (50.0)	0.43
Education level				
Primary school (Standard 7) or less	171 (91.9)	103 (93.6)	68 (89.5)	0.31
Secondary school (Form 4)	15 (8.1)	7 (6.4)	8 (10.5)	
Marital status				
Married	159 (85.5)	91 (82.7)	68 (89.5)	0.21
Single	10 (5.4)	5 (4.6)	5 (6.6)	
Widowed	13 (7.0)	11 (10.0)	2 (2.6)	
Divorced	4 (2.1)	3 (2.7)	1 (1.3)	
Monthly income (USD)				
Less than $25	76 (41.3)	46 (42.2)	30 (40.0)	0.70
Between $25-50	60 (32.6)	37 (33.9)	23 (30.7)	
More than $50	48 (26.1)	26 (23.9)	22 (29.3)	
Income earning activities				
Agriculture farming (binary)	177 (95.2)	102 (92.7)	75 (98.7)	0.06
Livestock farming (binary)	35 (18.8)	17 (15.5)	18 (23.7)	0.16
Other miscellaneous† (binary)	51 (27.4)	33 (30.0)	18 (23.7)	0.34
Travel mode to household visits				
Walk	117 (62.9)	69 (62.7)	48 (63.1)	0.81
Bicycle	54 (29.0)	31 (28.2)	23 (30.3)	
Motorcycle	15 (8.1)	10 (9.1)	5 (6.6)	

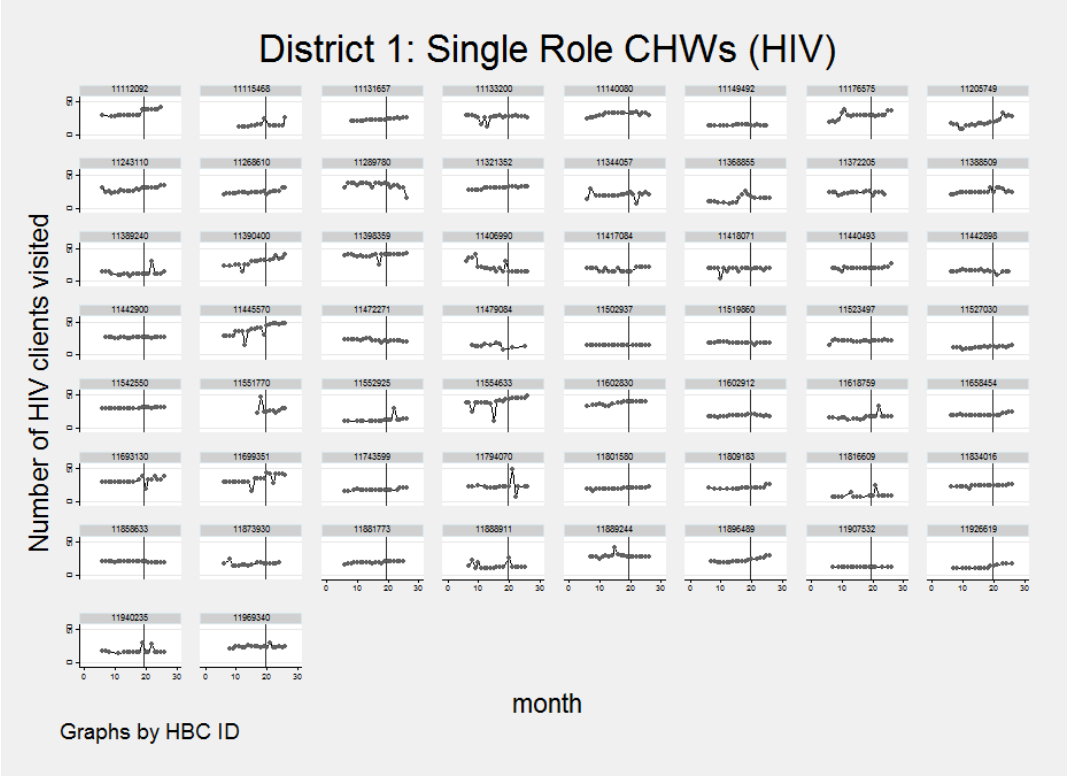
Supervisory facility travel time				
< 30 minutes	53 (28.6)	31 (28.4)	22 (28.9)	0.58
30-59 minutes	51 (27.6)	33 (30.3)	18 (23.7)	
≥ 60 minutes	81 (43.8)	45 (41.3)	36 (47.4)	
Supervisory facility distance (KM)	7.8 ± 11.0	8.5 ± 10.5	6.8 ± 11.6	0.33
Facility Characteristics	**Mean ± SD; or n (%)**			**p**
Supervisory facility type* **				
Dispensary	143 (76.5)	98 (88.3)	45 (59.2)	<0.001
Health Center	28 (15.0)	9 (8.1)	19 (25.0)	
District Hospital	16 (8.5)	4 (3.6)	12 (15.8)	
Supervisory facility ownership				
Government	125 (66.8)	80 (72.1)	45 (59.2)	0.07
Faith-Based	62 (33.2)	31 (27.9)	31 (40.8)	

*Significant at p-value<0.05 level; ** Significant at p-value<0.01 level; *** Significant at p-value<0.001 level
†Includes bartender, carpenter, cleaner, counselor, fisherman, grocer, miner, preacher, shop owner, small business, tailor, trader, or timber seller

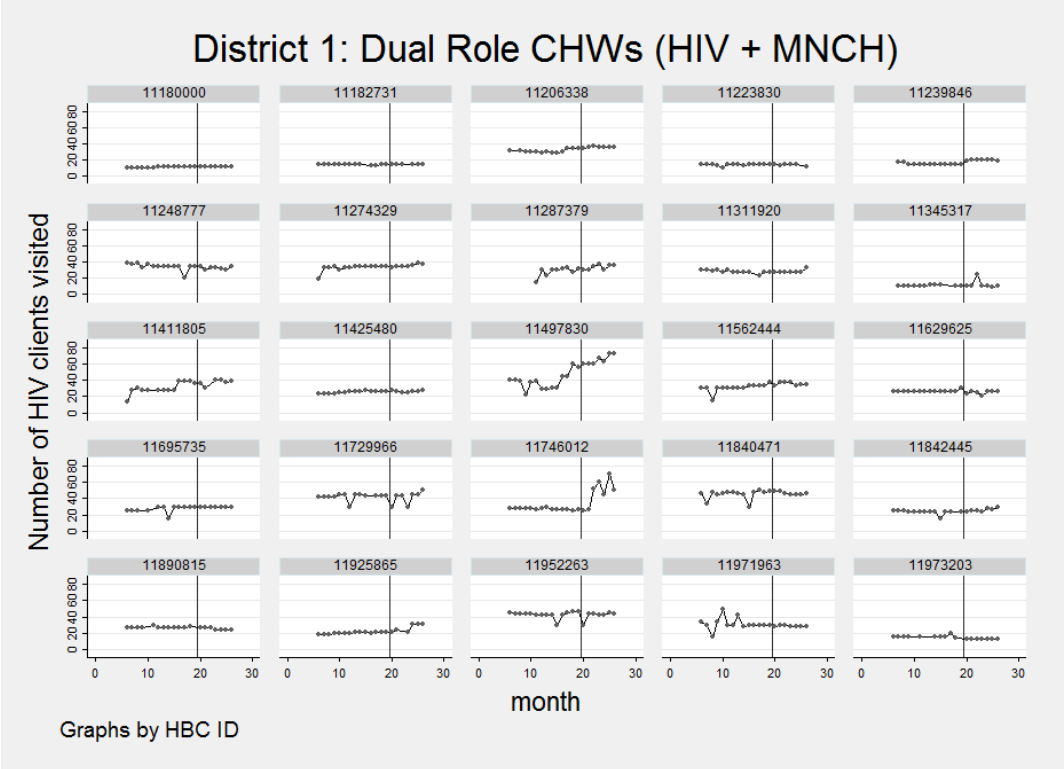
Patterns in Individual Outcomes Over Time, Comparing Single and Dual Role CHWs

Two way connected line plots were constructed to examine each CHW's trajectory in reported number of HIV household visits conducted per month before and after introduction of MNCH responsibilities, comparing plots for single and dual role CHWs by district (A5. Figure 1a-1b, 2a-2b). Data were graphed on a time axis from 1-26 months; District 1 contains data from 6 to 26 months and District 2 from 1 to 26 months. The vertical line at 19.5 months in District 1 and 14.5 months in District 2 demarcates the pre- and post-periods, indicating the intervention changepoint when MNCH training was introduced for dual role CHWs. In both districts, for the majority of CHWs the general trend in monthly HIV visits conducted remained stable over time, irrespective of single or dual role status. In District 1, the plots revealed no visual indication of a change in trend from the pre- to post-intervention period for dual role CHWs, with the exception of a few CHWs with an upward trend in the post-period (A5. Figure 1b). In District 2, the plots suggested more variability in the outcome over time, with some dual role CHWs displaying an upward or downward trend in the post-period (A5. Figure 2b).

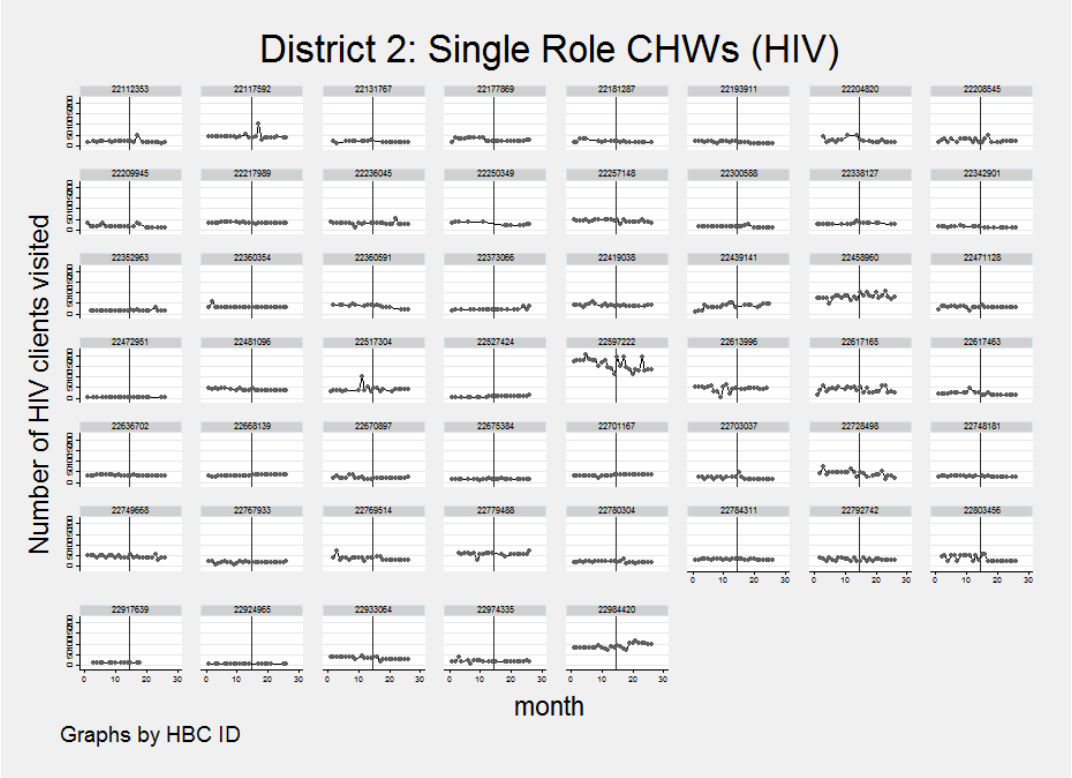
A5. Figure 1a. Time trends in HIV clients visited per month by single role CHWs in District 1.



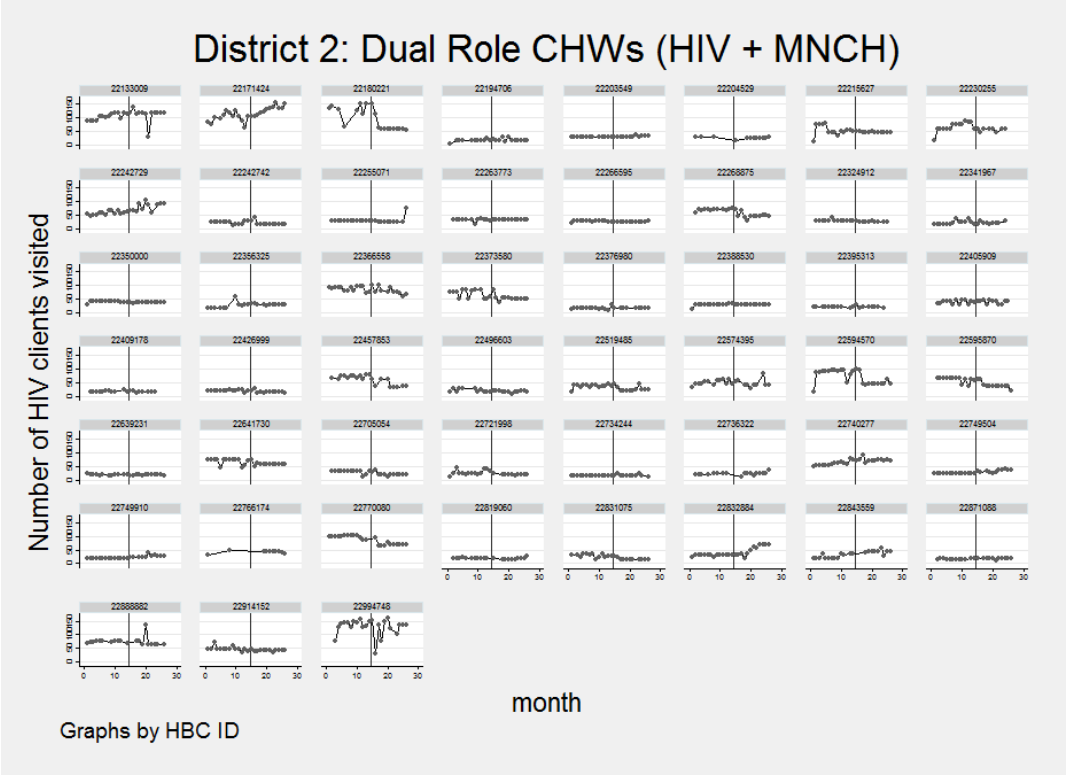
A5. Figure 1b. Time trends in HIV clients visited per month by dual role CHWs in District 1.



A5. Figure 2a. Time trends in HIV clients visited per month by single role CHWs in District 2.



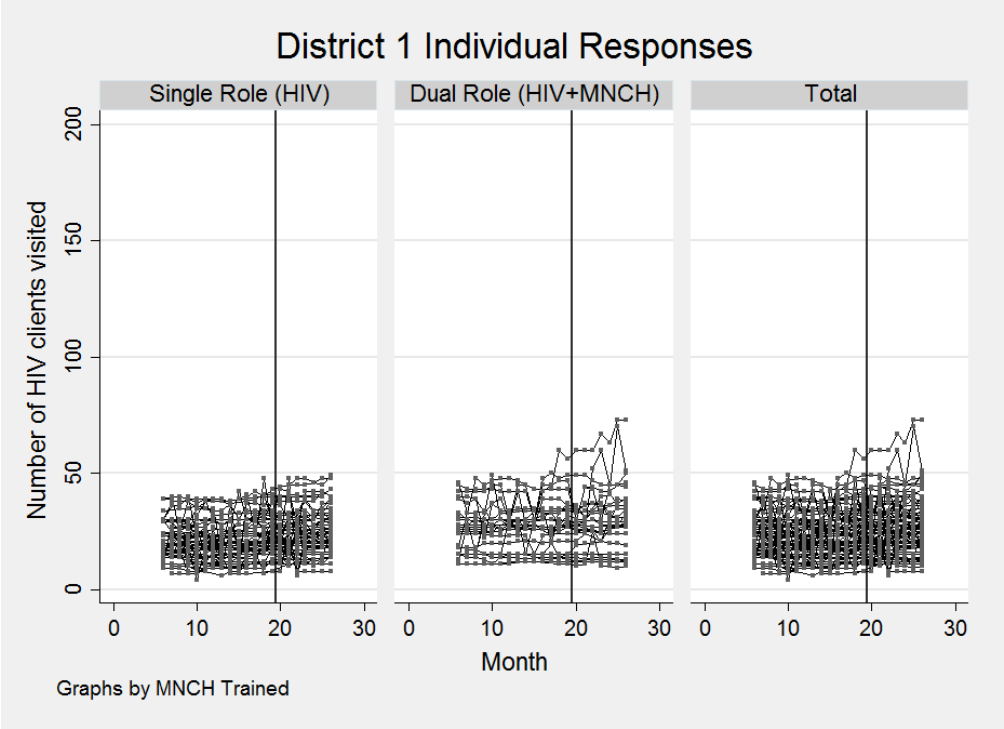
A5. Figure 2b. Time trends in HIV clients visited per month by dual role CHWs in District 2.



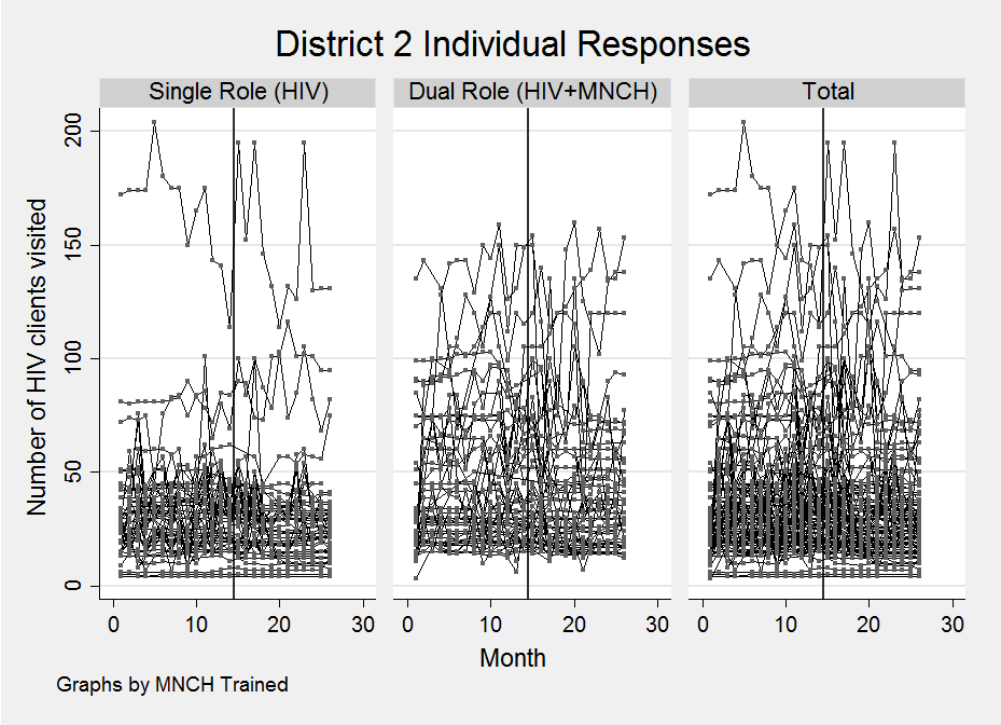
Spaghetti Plots

After examination of individual patterns, individual response profiles were overlaid on a single graph to construct spaghetti plots to visually explore patterns in repeated measures over time for single role, dual role, and the total sample of CHWs within each district. The spaghetti plots served as a data quality check for reasonable values in the outcome measure and allowed for examination of trends in how most CHWs performed over time, as well as outlier CHW trajectories that differed from most other CHWs. In District 1, patterns were similar across single and dual role CHWs, with most reporting less than 50 HIV clients visited per month (A5. Figure 3a). In District 2, there was increased variability between groups: most single role CHWs reported less than 50 HIV clients visited per month, but there were some CHWs with much higher levels of performance (up to 200 HIV clients visited per month); whereas dual role CHWs displayed much larger variability in the reported outcome ranging from 20 to 150 HIV clients visited per month (A5. Figure 3b).

A5. Figure 3a. Individual trends in HIV visits per month for single vs. dual role CHWs in District 1.



A5. Figure 3b. Individual trends in HIV visits per month for single vs. dual role CHWs in District 2.

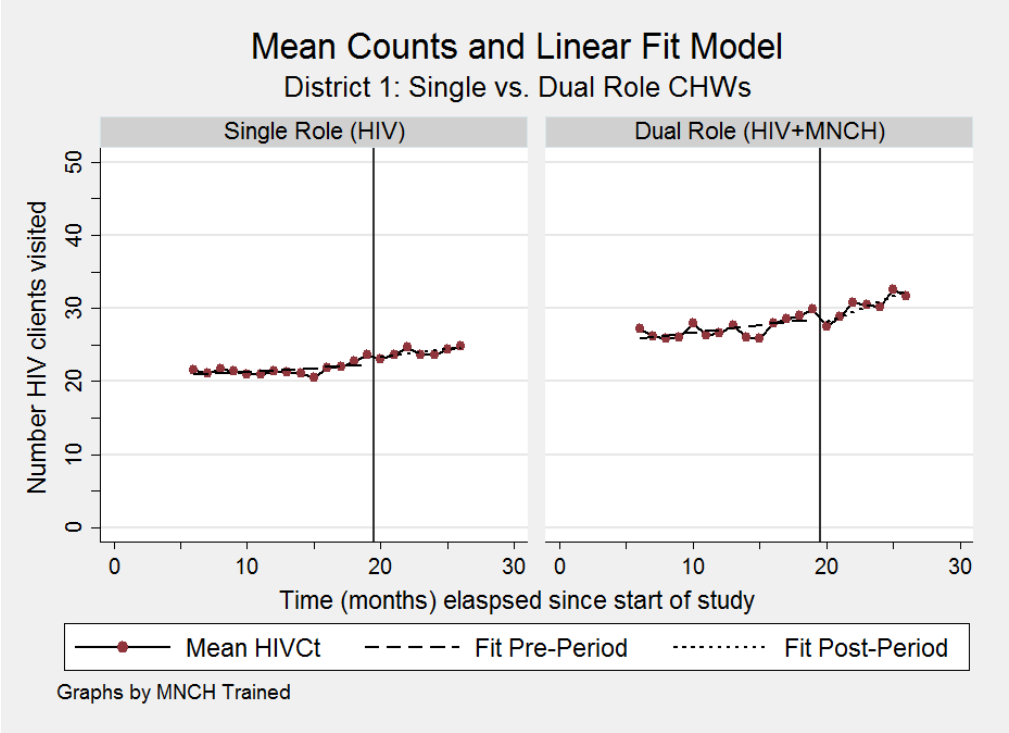


Mean Response Profiles Over Time, Comparing Single and Dual Role CHWs

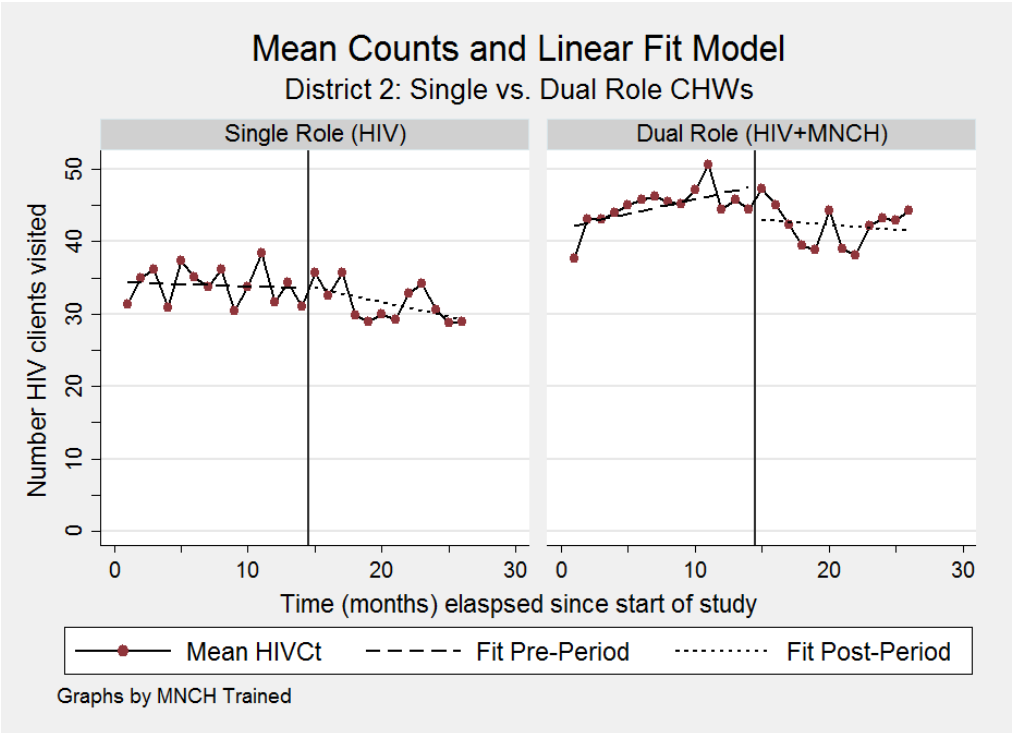
To explore typical response patterns as a function of time, within each district, graphs of the linear fit of HIV visit count regressed on time compared fitted values in the pre- and post-periods for single role, dual role, and all CHWs. In addition, outcome data were collapsed to create the mean number of HIV clients visited per month among single versus dual role CHWs, stratified by district. The mean number of HIV client visits were plotted over time along with the linear fit of mean HIV visit count regressed on time to compare trends for single and dual role CHWs before and after introduction of MNCH responsibilities (A5. Figure 4 and Figure 5).

Visually, the two graphs highlight differences in data trends by district. For both districts, the greater mean count of HIV client visits per month was notable in comparing dual role to single role CHWs. During the pre-period in District 1, both single and dual role CHWs showed an increasing trend in average number of HIV clients visited per month which continued into the post-period (A5. Figure 4). However, in District 2, the pre-period trends in mean HIV clients visited per month varied by group, with a flat trend for single role CHWs and an increasing trend for dual role CHWs (A5. Figure 5). In the post-period, a decreasing trend was evident for both single and dual role CHWs in District 2, with similar slopes but a higher mean level for dual role CHWs. Differing patterns in the outcome over time by district suggested the need to build separate ITS regression models for each district.

A5. Figure 4. Fitted values of mean HIV clients visited per month regressed on time for single and dual role CHWs in District 1.



A5. Figure 5. Fitted values of mean HIV clients visited per month regressed on time for single and dual role CHWs in District 2.



Model Diagnostics: QIC Statistics for GEE Model Selection

Unadjusted and adjusted comparative interrupted time series analyses were run using a GEE approach. Quasi-likelihood information criterion (QIC) statistics were examined to determine the most appropriate working correlation structure: exchangeable versus independent (note: an unstructured correlation structure was also tested but failed to converge), and most parsimonious model. As indicated in A5. Table 1, the exchangeable correlation structure had the smallest absolute QIC values for both unadjusted and adjusted models in Iringa Rural and for the adjusted model in Kilolo. Therefore, the exchangeable correlation structure was adopted for the final GEE models. Furthermore, for both districts, the QICu value was smallest in the fully adjusted model compared to the unadjusted model, suggesting the covariates (rainy season, facility ownership, facility type, travel time to facility, and CHW's sex, years of experience, and income) should remain in the final interrupted time series models.

A5. Table 1. QIC Statistics for GEE Model Selection

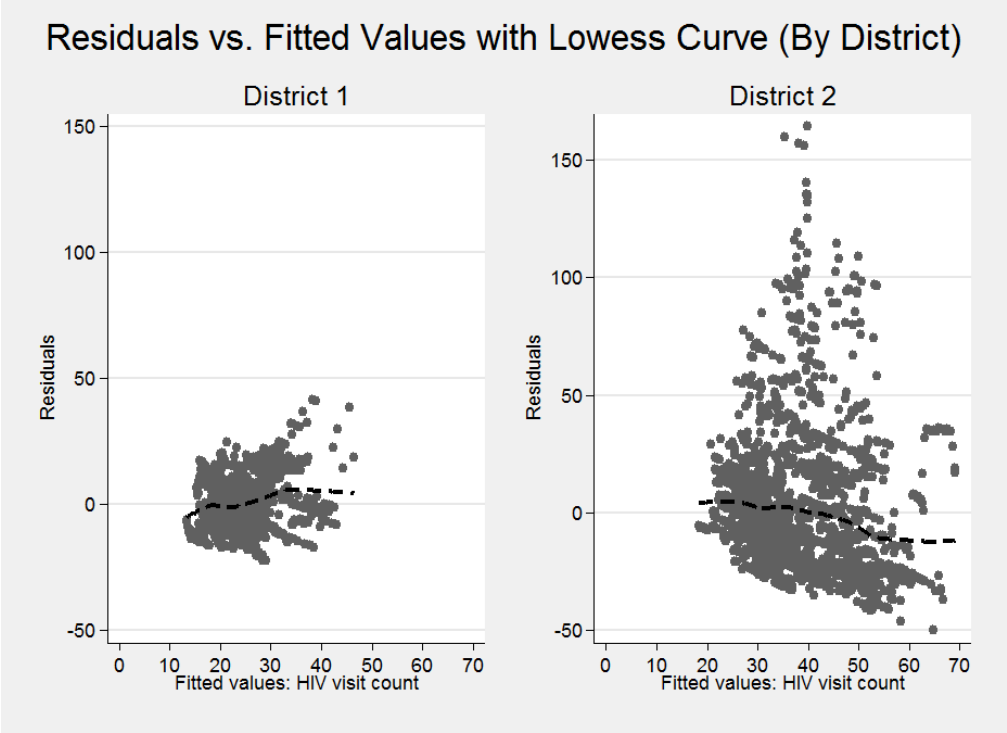
Models	Correlation Structure*		Covariate Selection†	
	QIC (Exchangeable)	QIC (Independent)	QICu (Exchangeable)	QICu (Independent)
Iringa Rural				
Unadjusted	**-636052.5**	-636781.6	-636052.5	-637025.8
Adjusted	**-621357.5**	-623252.0	**-622498.8**	-624114.0
Kilolo				
Unadjusted	-640951.6	**-640100.5**	-642714.0	-641956.8
Adjusted	**-615893.1**	-628762.2	**-626313.7**	-635344.2

*QIC is used to determine working correlation structure: select the model with the smallest QIC values (bold) relative to the comparison model (i.e. QIC Exchangeable vs. Independent within a particular model specification)
†QICu is used to determine the most parsimonious covariate selection: Compare unadjusted vs. adjusted (full) model using the best correlation structure (exchangeable in this case)

Model Diagnostics: Residuals versus Fitted Values

After fitting GEE models for each district, residuals were calculated from the difference between the estimated and observed values of the dependent variable, mean HIV visit count per month. A plot of the residuals versus the fitted values with a locally-weighted scatterplot smoothing (lowess) curve was examined to check model assumptions (A5. Figure 6). In District 1, the residuals largely fall within a horizontal band around 0, indicating the model assumptions are probably correct. In District 2, more variability in the residuals plot is evident, which suggests the variance is not constant but changes as the mean of HIV visit count changes – this pattern is likely due to the greater number of outliers in the District 2 dataset.

A5. Figure 6. Plot of residuals versus fitted values of mean HIV client visits per month, by district.



Logistic Regression Model to Assess Odds of Selection for MNCH Training

Given that the criteria for selection to receive MNCH training were not explicitly detailed by the regional implementing partner, the predicted odds (or propensity) of being selected to receive MNCH training was assessed to explore the potential for selection bias. A logistic regression modeled the odds of receiving MNCH training, after controlling for select CHW demographic covariates (sex, education level, years of experience, and income category) and facility characteristics (type of facility, ownership of facility, and travel time from CHW's village to facility). Results confirm there was no significant association between a CHW's sex, years of experience, education level, or income and their odds of receiving the training (A5. Table 3). However, CHWs that reported to a health center (AOR: 5.24, 95% CI: 2.06–13.3, p=0.001) or hospital (AOR: 10.12, 95% CI: 2.29–44.8, p=0.002) had a higher likelihood of receiving the MNCH training compared to CHWs reporting to dispensary level health facilities. Box plots of the propensity to receive MNCH training by each covariate are displayed in A5. Figure 7a-7b; there is clear visual indication that CHWs at dispensaries had a lower likelihood of receiving the MNCH training.

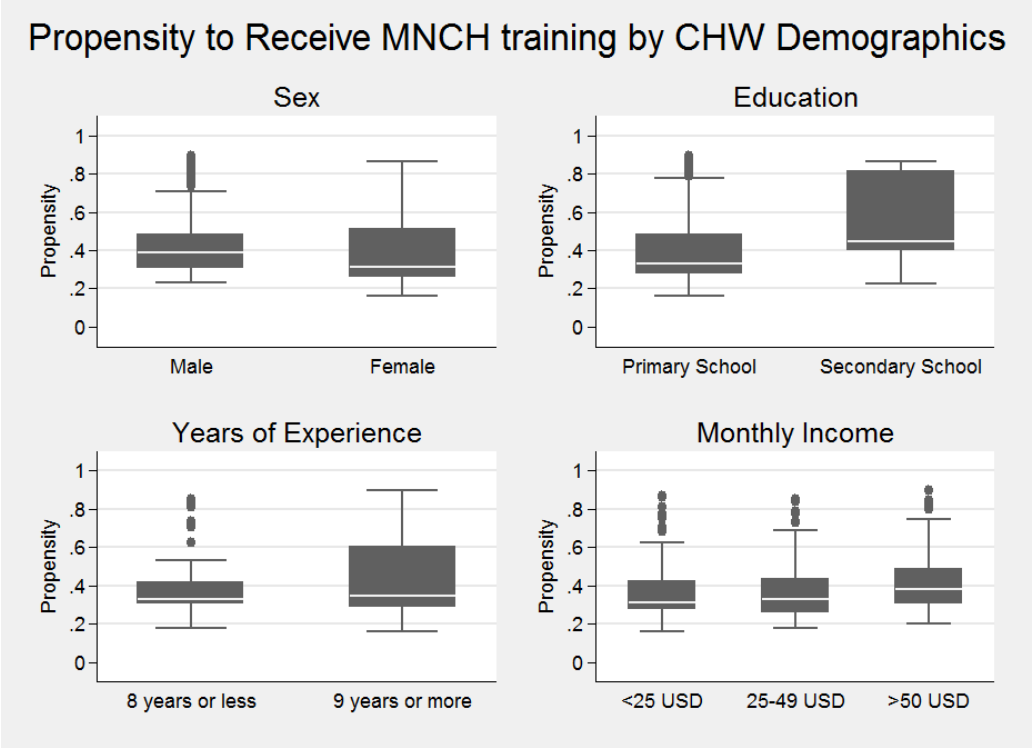
As a sensitivity analysis, the propensity for selection to receive MNCH training was divided into quintiles and added as a covariate in the ITS analysis using the GEE approach, but was not found to be significantly associated with HIV visit count nor to influence key parameter estimates (data not shown).

A5. Table 3. Logistic regression results of the odds to receive MNCH training controlling for CHW demographics and facility characteristics.

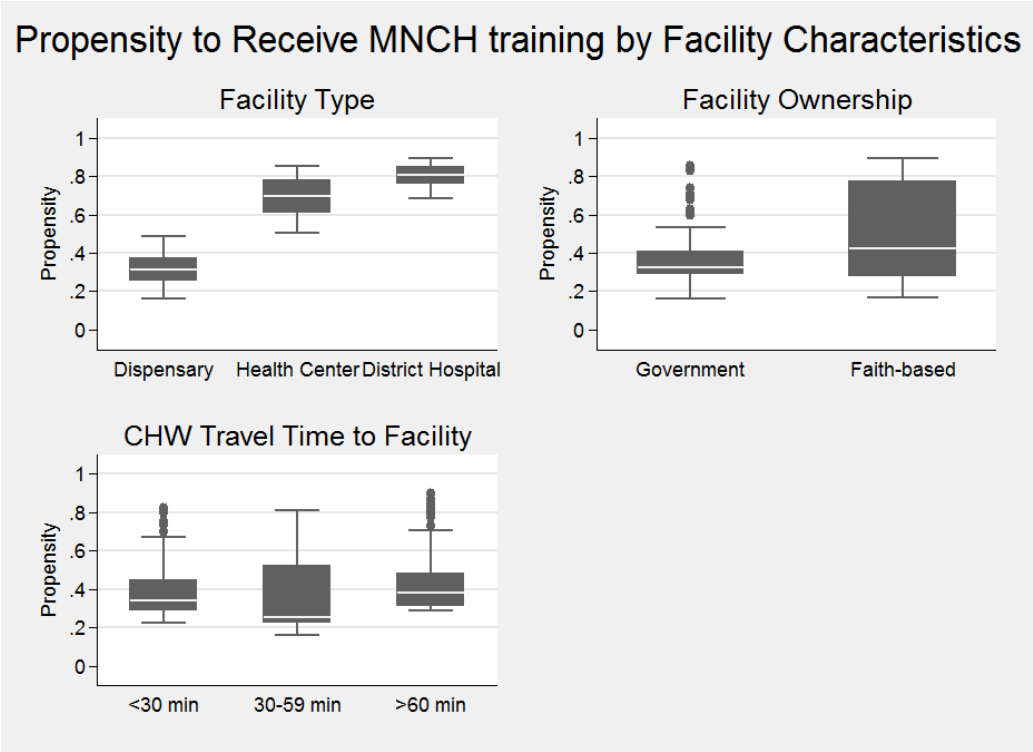
Model parameters	Adjusted OR (95% CI)
Intercept	0.74 (0.15–3.64)
CHW's Sex (Ref: Male)	0.64 (0.33–1.25)
CHW's Education (Ref: Primary School)	1.45 (0.44–4.82)
CHW's years of experience (Ref: <9 years)	0.89 (0.45–1.77)
CHW's income: $25-50/mo. (Ref: <$25/mo.)	1.07 (0.49–2.33)
CHW's income: >$50/mo. (Ref: <$25/mo.)	0.99 (0.57–2.93)
Facility ownership (Ref: Government)	1.04 (0.47–2.30)
Facility type: Health Center (Ref: Dispensary)	5.24 (2.06–13.3)*
Facility type: Hospital (Ref: Dispensary)	10.12 (2.29–44.8)*
Facility travel time: 30-59 min. (Ref: <30 min.)	0.67 (0.27–1.66)
Facility travel time: ≥60 min. (Ref: <30 min.)	1.42 (0.64–3.14)

*Significant at p-value<0.01 level; OR = Odds Ratio

A5. Figure 7a. Box plots of propensity to receive MNCH training, by CHW demographics.

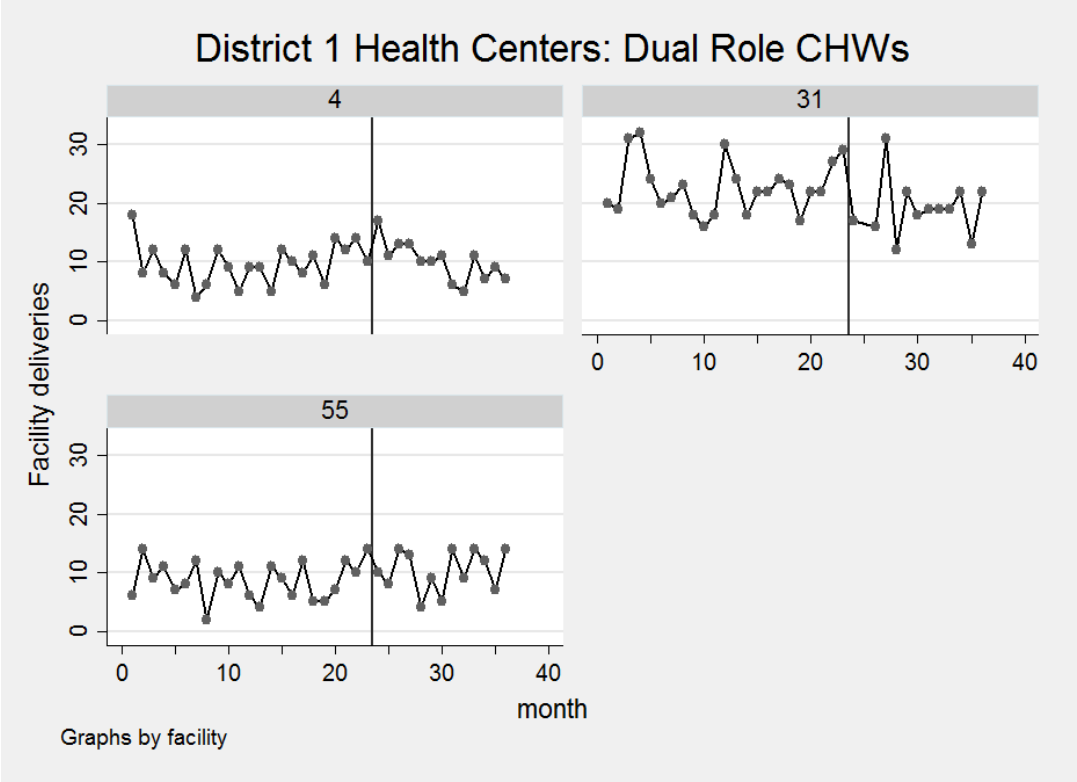


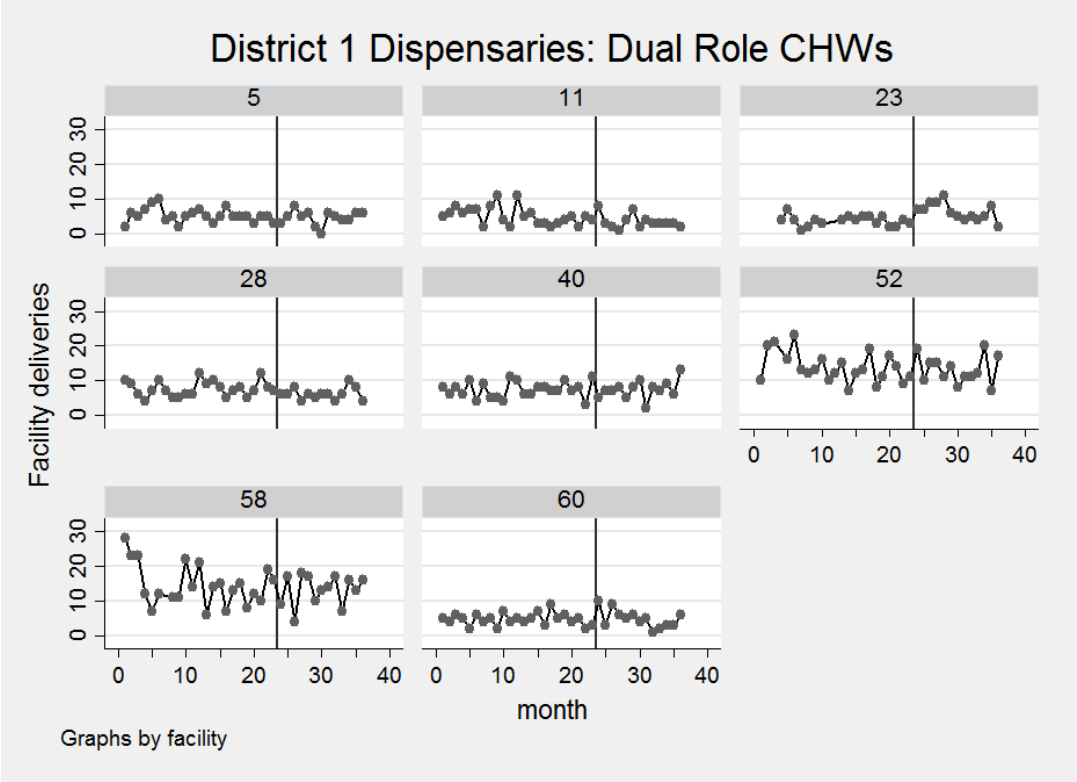
A5. Figure 7b. Box plots of propensity to receive MNCH training, by facility characteristics.

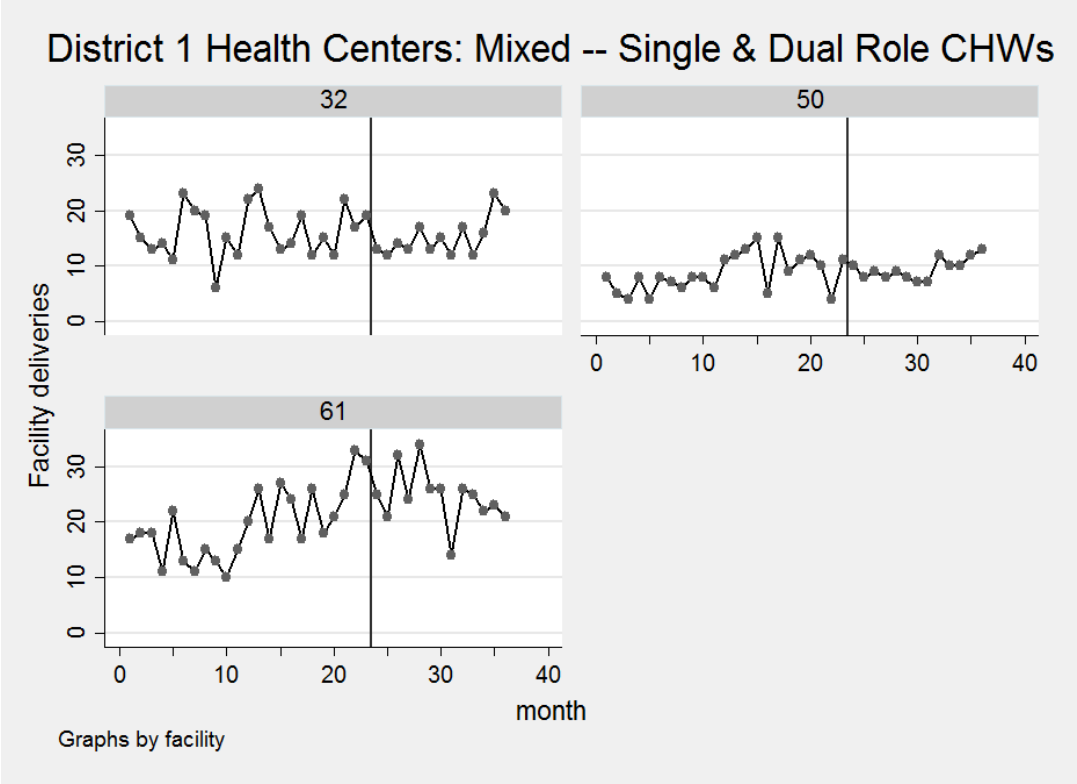


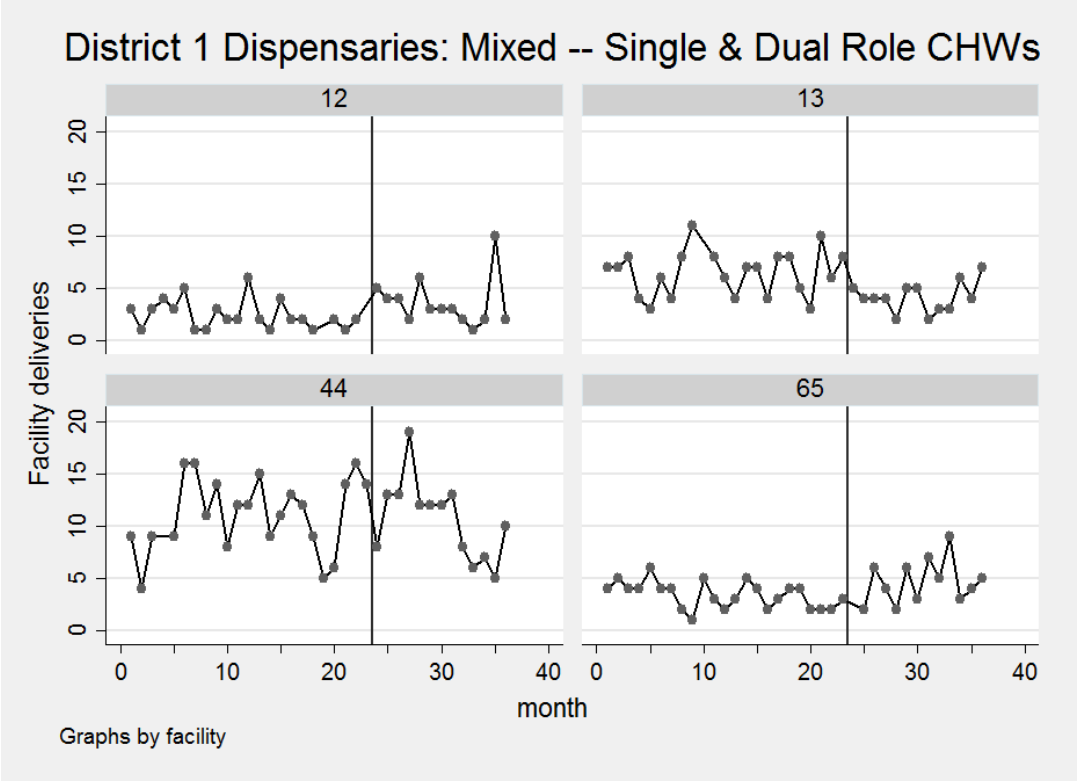
Appendix 6. *Supplementary statistical analyses for Chapter 3 (Manuscript 2)*

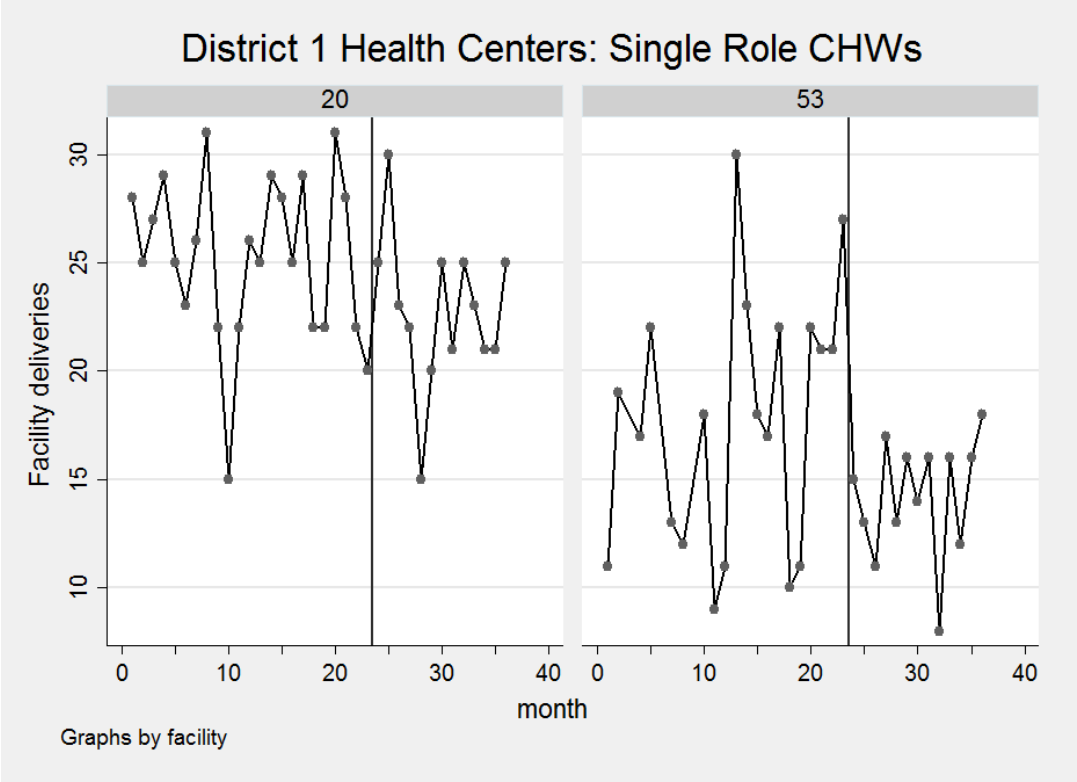
Time Series Plots by Facility & CHW Type for Iringa Rural (District 1)

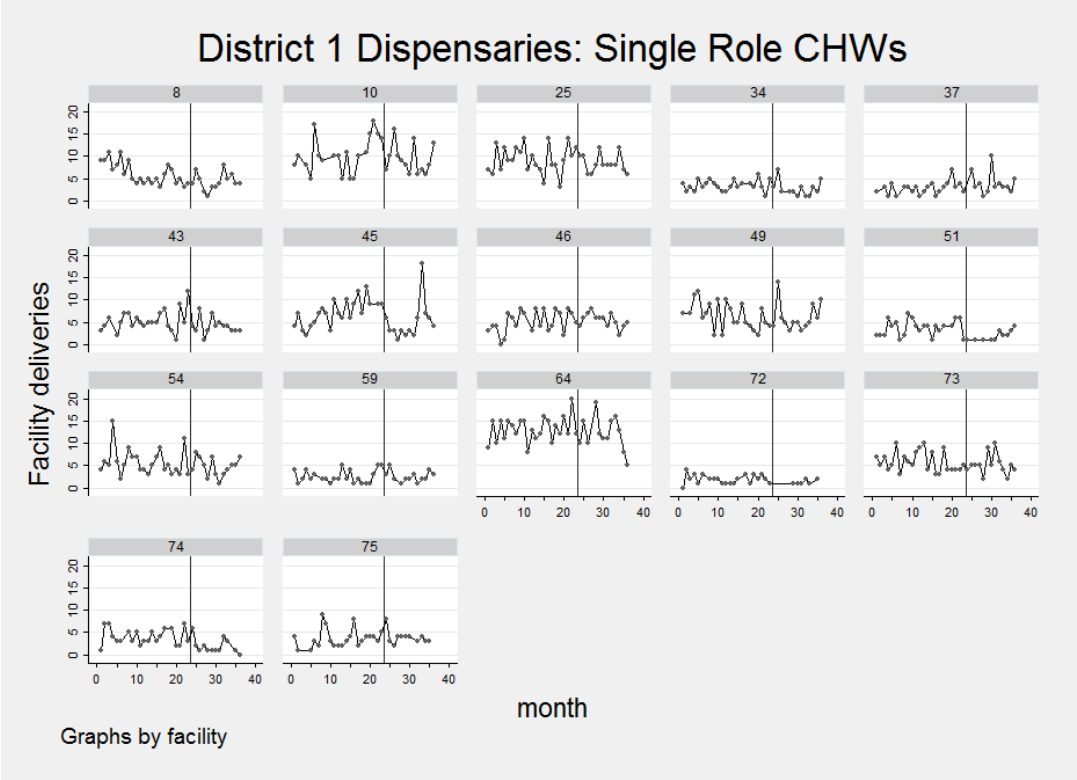




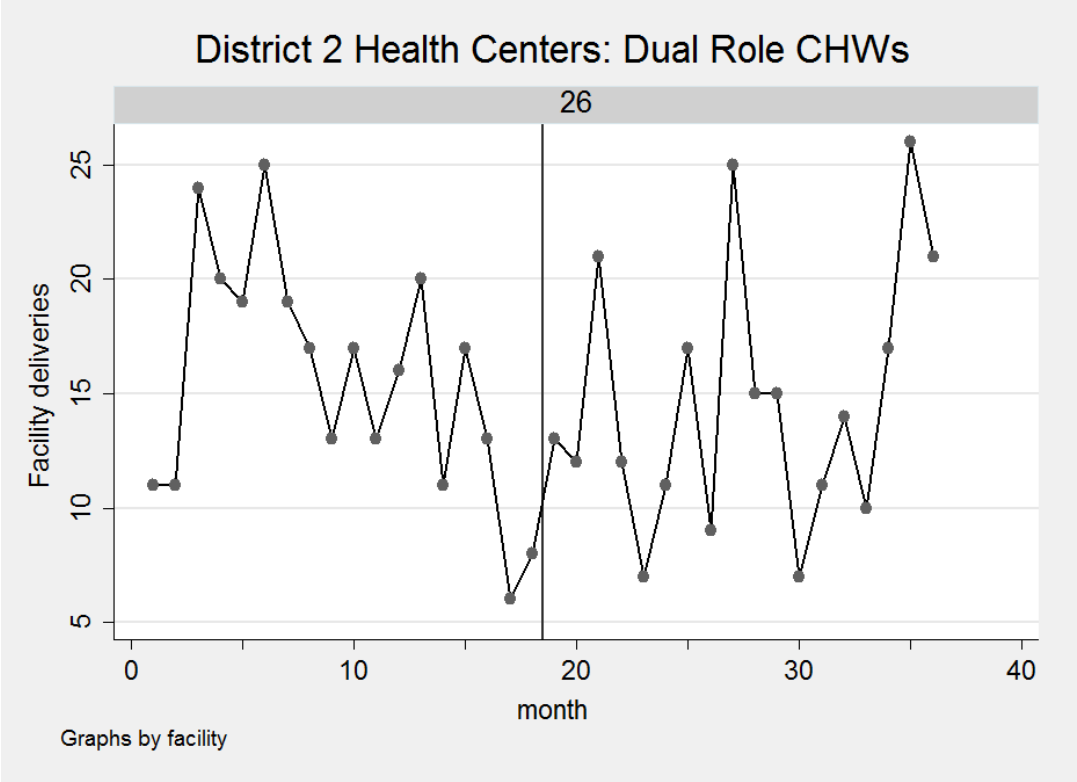

District 1 Health Centers: Mixed -- Single & Dual Role CHWs
32
50
61
Facility deliveries
0
10
20
30
40
month
Graphs by facility

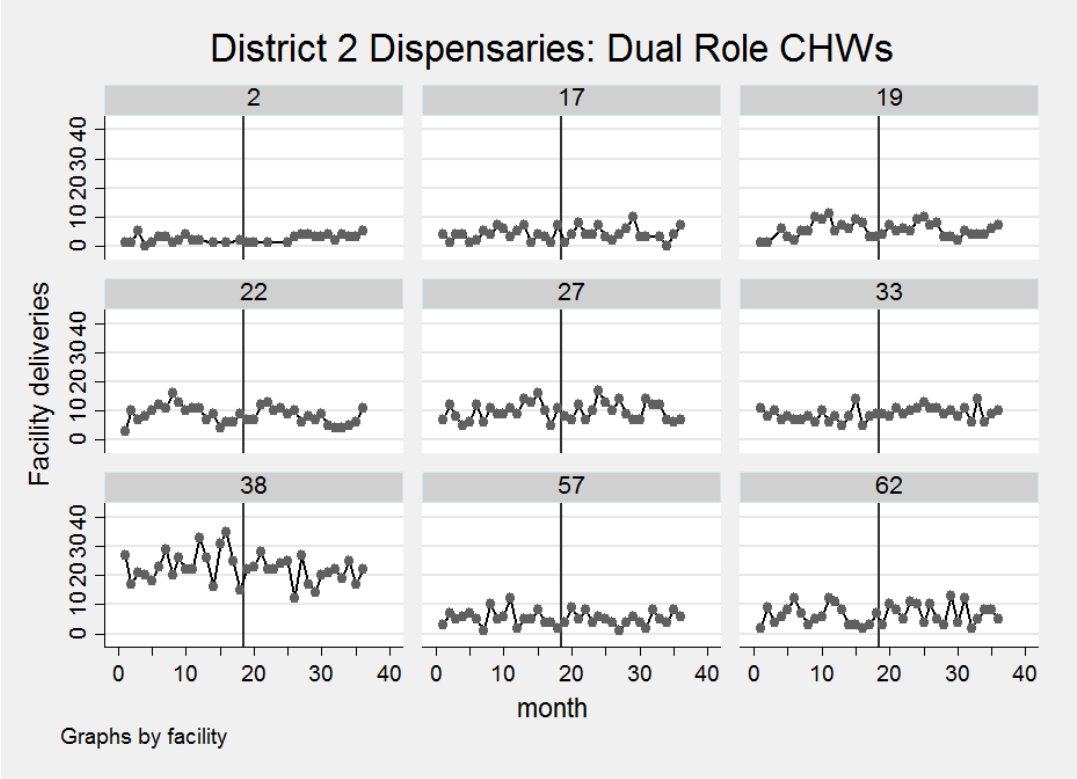

District 1 Dispensaries: Mixed -- Single & Dual Role CHWs
12
13
44
65
Facility deliveries
0
5
10
15
20
month
Graphs by facility

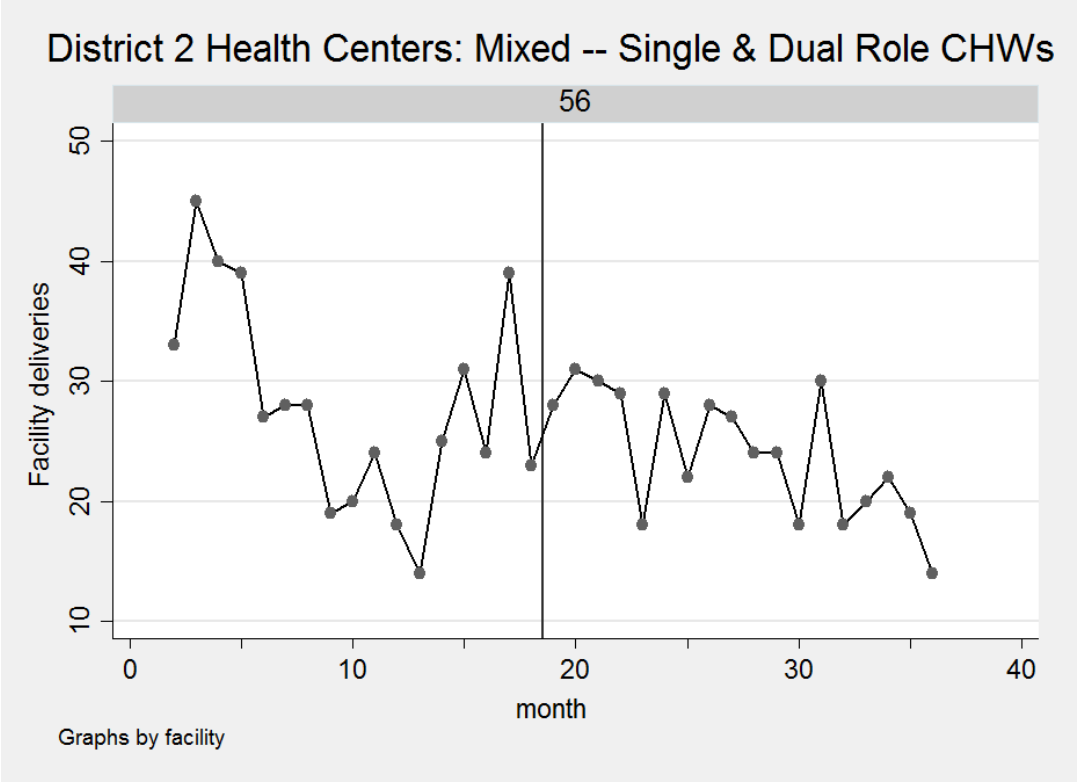

District 1 Health Centers: Single Role CHWs
20
53
Facility deliveries
10
15
20
25
30
0
10
20
30
40
month
Graphs by facility

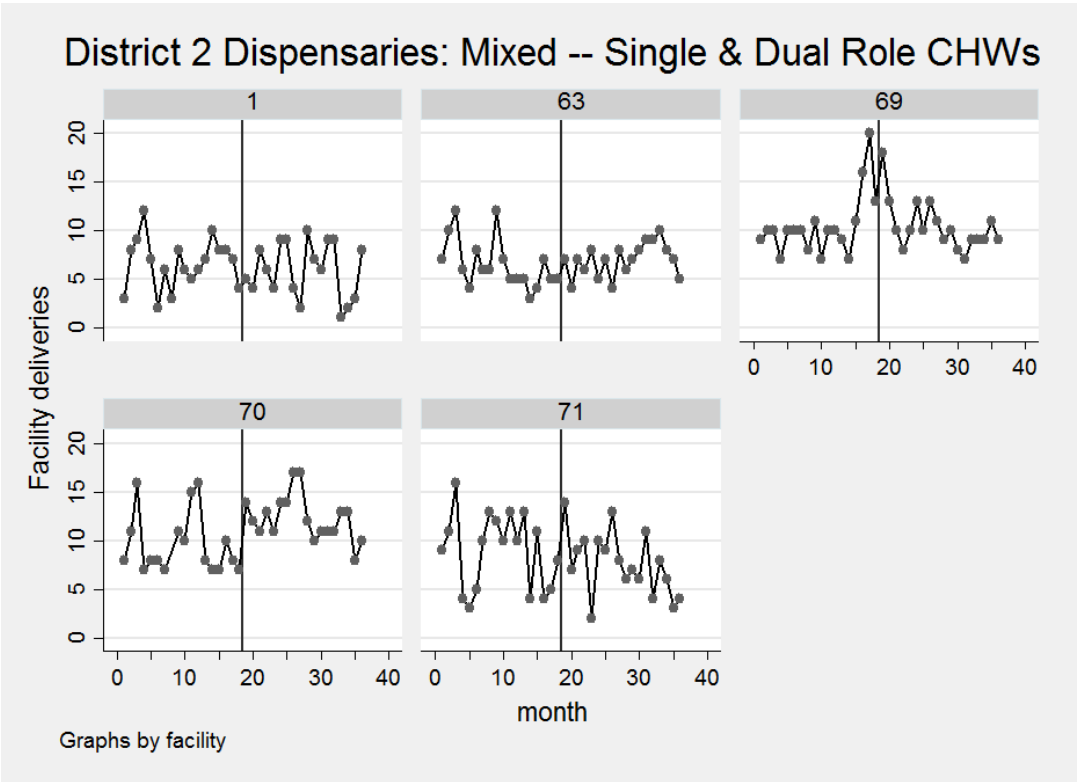

District 1 Dispensaries: Single Role CHWs
8
10
25
34
37
43
45
46
49
51
54
59
64
72
73
74
75
Facility deliveries
0
5
10
15
20
0
10
20
30
40
month
Graphs by facility

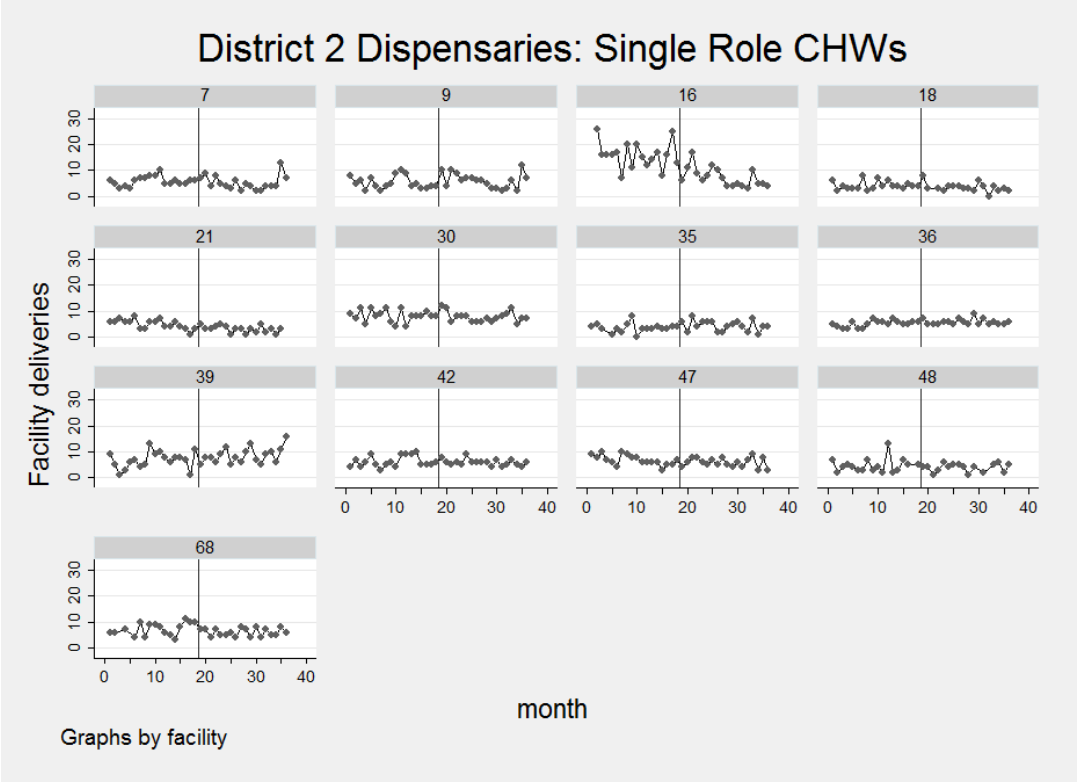
Time Series Plots by Facility & CHW Type for Kilolo (District 2)






District 2 Health Centers: Mixed -- Single & Dual Role CHWs
56
Facility deliveries
10
20
30
40
50
0
10
20
30
40
month
Graphs by facility


District 2 Dispensaries: Mixed -- Single & Dual Role CHWs
1
63
69
70
71
Facility deliveries
0
5
10
15
20
0
10
20
30
40
month
Graphs by facility


District 2 Dispensaries: Single Role CHWs
7
9
16
18
21
30
35
36
39
42
47
48
68
Facility deliveries
0 10 20 30
0 10 20 30 40
month
Graphs by facility

A6. Table 1. Hospital-level model: Single group pre- versus post-period estimates, by district, unadjusted and adjusted for seasonality.

Facility Deliveries	**District 1**		**District 2**	
Pre- versus Post Parameters	**IRR (95% CI)**	**Adj. IRR (95% CI)**	**IRR (95% CI)**	**Adj. IRR (95% CI)**
Intercept (β_0)	202.1 (192.0–213.3) ***	206.1 (194.6–218.2) ***	167.6 (159.1–176.7) ***	159.3 (144.7–175.3) ***
Difference in level, immediate post (β_1)	1.16 (1.06–1.26) ***	1.16 (1.07–1.26) ***	1.16 (1.08–1.24) ***	1.15 (1.08–1.22) ***
Calendar month (Ref=January)		0.95 (0.86–1.02)		0.98 (0.92–1.04)
February		1.00 (0.87–1.16)		0.94 (0.83–1.07)
March		1.09 (0.94–1.27)		1.11 (0.98–1.26)
April		1.03 (0.88–1.21)		1.08 (0.95–1.23)
May		1.02 (0.87–1.19)		1.12 (0.98–1.27)
June		1.04 (0.89–1.22)		1.03 (0.90–1.17)
July		0.99 (0.84–1.16)		1.01 (0.89–1.16)
August		1.21 (1.05–1.41) *		1.10 (0.96–1.25)
September		1.03 (0.88–1.20)		1.12 (0.98–1.27)
October		1.19 (1.03–1.39) *		1.07 (0.94–1.22)
November		1.16 (1.00–1.35) *		1.01 (0.88–1.15)
December		1.05 (0.91–1.22)		1.07 (0.94–1.20)
Estimated within facility autocorrelation†	0.09	0.18	0.16	0.16

*Significant at: *p* value<0.05 level; ** *p*-value<0.01 level; *** *p*-value<0.001 level
IRR = Incidence Rate Ratio
Adj.=Adjusted
†AR1 correlation structure

A6. Table 2. Health Center / Dispensary-level model: Difference-in-difference estimates, by district, unadjusted and adjusted for seasonality and facility covariates.

Facility Deliveries	**District 1**		**District 2**	
Difference-in-Difference Parameters	**IRR (95% CI)**	**Adj. IRR (95% CI)**	**IRR (95% CI)**	**Adj. IRR (95% CI)**
Intercept (β_0)	7.30 (5.10–10.45) ***	7.76 (5.31–11.34) ***	6.28 (4.75–8.30) ***	6.12 (4.70–7.96) ***
Difference intervention vs. control groups (β_1)	1.35 (0.84–2.17)	1.39 (0.86–2.25)	1.48 (0.97–2.26)	1.54 (1.02–2.32) *
Difference post vs. pre-period (β_2)	0.84 (0.70–1.01)	0.76 (0.63–0.92) **	0.95 (0.74–1.21)	0.92 (0.73–1.15)
Difference-in-difference (β_3)	1.12 (0.87–1.44)	1.11 (0.85–1.44)	1.16 (0.89–1.50)	1.14 (0.88–1.47)
Calendar month (Ref=January)				
February		0.98 (0.89–1.07)		0.98 (0.85–1.14)
March		1.03 (0.95–1.11)		1.11 (0.99–1.25)
April		0.92 (0.84–1.01)		0.97 (0.86–1.09)
May		0.96 (0.88–1.05)		0.99 (0.83–1.17)
June		0.94 (0.87–1.01)		0.94 (0.85–1.04)
July		0.85 (0.77–0.94) ***		1.01 (0.88–1.15)
August		0.91 (0.83–1.00)		0.99 (0.89–1.11)
September		0.95 (0.85–1.07)		1.10 (1.02–1.19) *
October		0.95 (0.86–1.05)		0.99 (0.90–1.09)
November		0.90 (0.82–0.98) *		1.04 (0.93–1.17)
December		1.03 (0.94–1.13)		1.09 (0.99–1.21)
Estimated within facility autocorrelation†	0.80	0.81	0.76	0.76

*Significant at: *p* value<0.05 level; ** *p*-value<0.01 level; *** *p*-value<0.001 level
IRR = Incidence Rate Ratio
Adj.=Adjusted
†AR1 correlation structure

Model Diagnostics: QIC Statistics for GEE Model Selection

A6. Table 3. QIC Statistics for GEE Model Selection for ITS models.

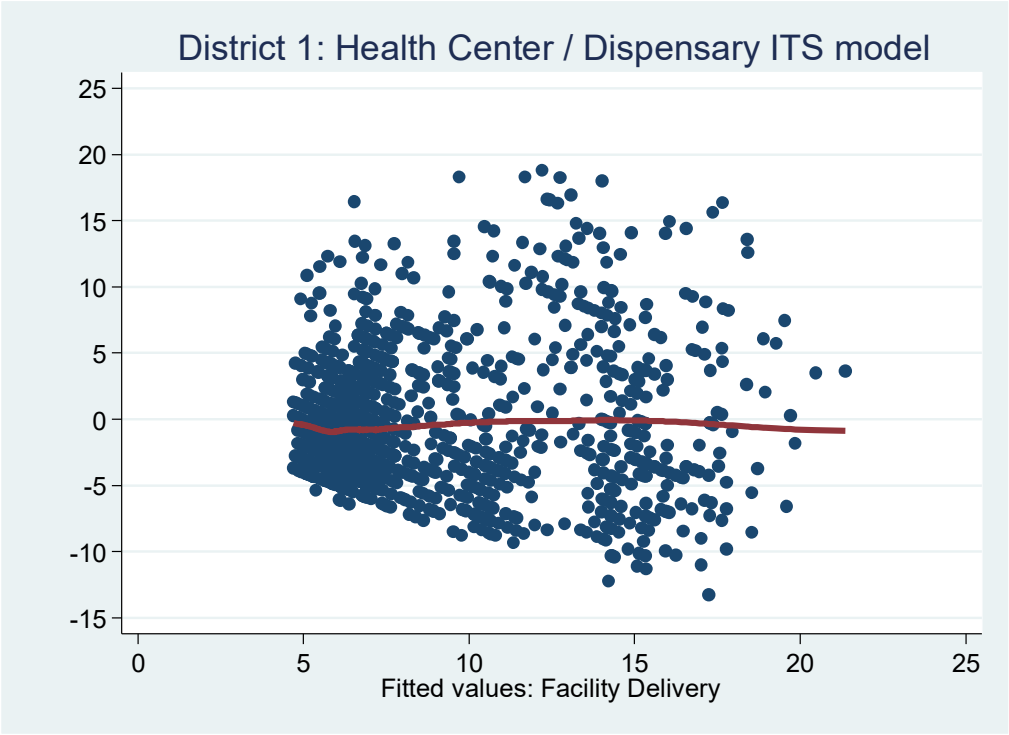
Models	Correlation Structure* QIC: Exchangeable	QIC: Autoregressive1	QIC: Independent	Covariate Selection† QICu: Autoregressive1
District 1				
Unadjusted	-42711.6	**-42654.2**	-42711.6	**-43248.1**
Adjusted	-45736.9	**-45460.5**	-45585.3	-46184.4
District 2				
Unadjusted	-42886.9	**-42884.7**	-42887.7	**-43261.6**
Adjusted	**-45455.9**	-45889.2	-45890.2	-46466.4

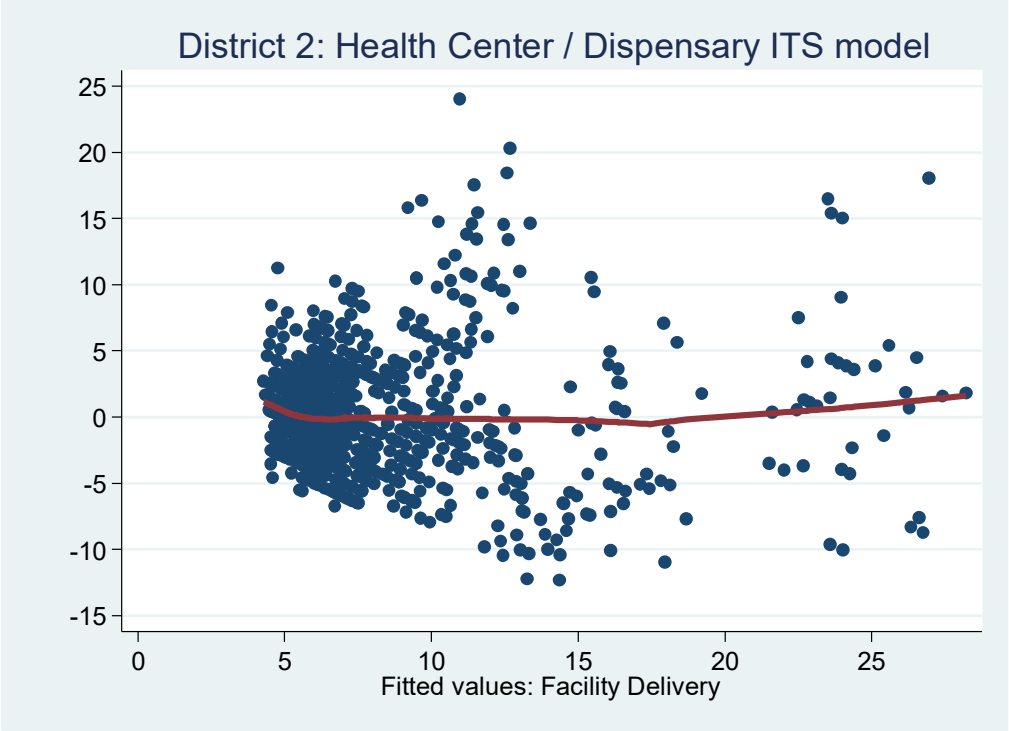
*QIC is used to determine the most appropriate working correlation structure: select the model with the smallest QIC values (bold) relative to the comparison model (i.e. QIC Exchangeable vs. Autoregressive 1 vs. Independent within a particular model specification)

†QICu is used to determine the most parsimonious covariate selection: Compare unadjusted vs. adjusted (full) model using the most appropriate correlation structure – in both cases, the unadjusted model selection is preferred as indicated by the QICu value.

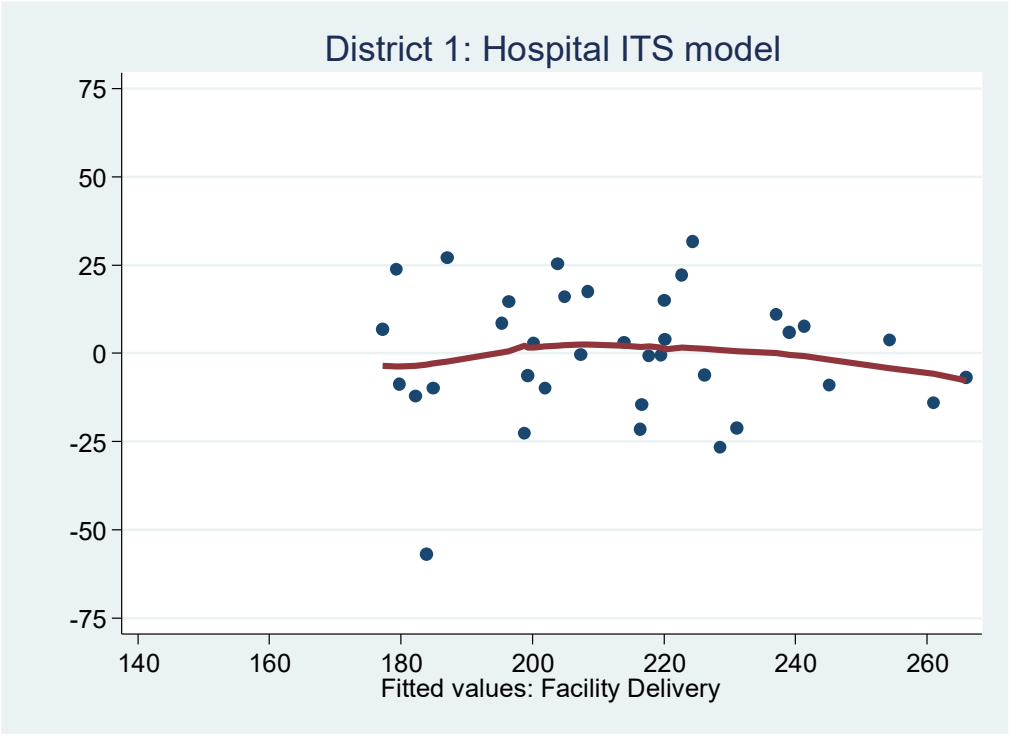
Model Diagnostics: Residuals versus Fitted Values

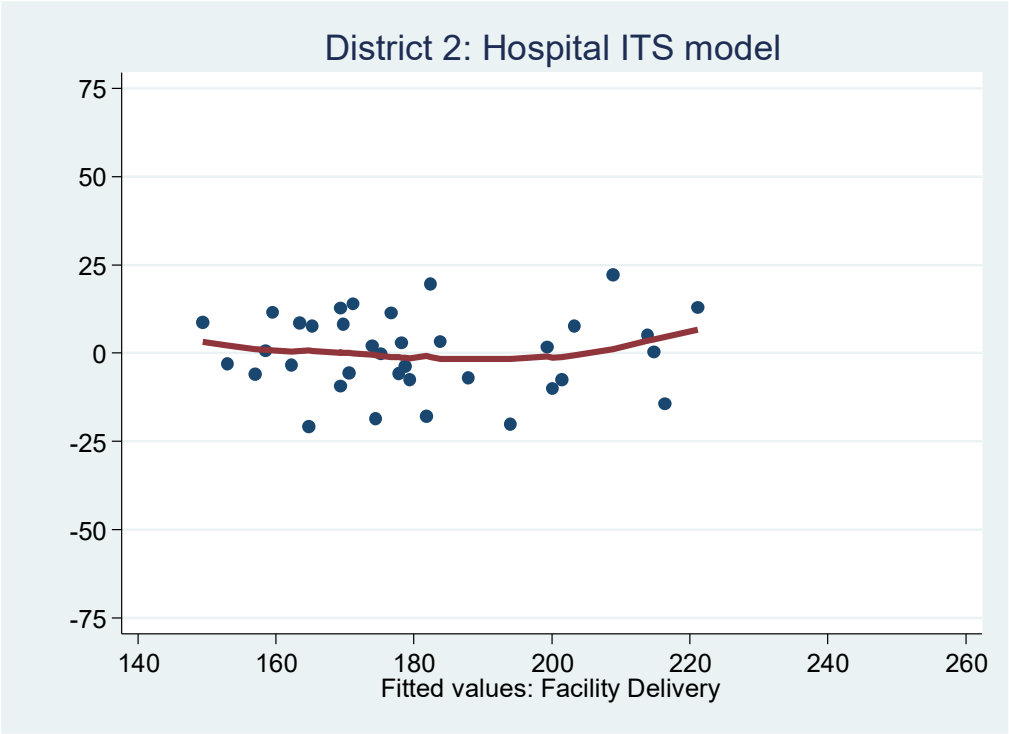
A6. Figure 1. Corresponds to Table 4, fully adjusted model





A6. Figure 2. Corresponds to Table 5, adjusted for seasonality





Curriculum Vitae

KATHARINE D. SHELLEY, MPH

PhD candidate in International Health with a focus on health systems research, primary health care, HIV/AIDS, maternal and child health, implementation research, and translating evidence to action. Eleven years of public health experience working with academic researchers, non-governmental organizations, and Ministries of Health.

EDUCATION

Johns Hopkins Bloomberg School of Public Health **Baltimore, MD**
PhD Candidate, International Health (Health Systems) Expected 2017
Dissertation: CHW Role Expansion from HIV to Maternal, Newborn and Child Health in Iringa, Tanzania: A Mixed Methods Case Study Design

George Washington School of Public Health and Health Services **Washington, DC**
Graduate Certificate: Global Health (International Health Promotion) January 2010
Master of Public Health: Epidemiology-Biostatistics (Epi Methods) August 2007
Thesis: HIV/STD Reproductive Health Education in the District of Columbia: An Evaluation of the Making Proud Choices! Program

Colgate University **Hamilton, NY**
Bachelor of Arts: Geography May 2005
Thesis: Mastering Malaria in Sub-Saharan Africa and Southeast Asia: the Geographic Correlates of Variation and the Efficacy of Control Strategies

PROFESSIONAL EXPERIENCE

Johns Hopkins School of Public Health **Baltimore, MD**

Graduate Research Assistant, National Evaluation Platform Tanzania (Nov 2016-Jan 2017)
- Developed training materials and co-facilitated training and data collection for a qualitative assessment of perceptions of quality of antenatal care services in Tanga, Tanzania

Co-Investigator, CHW Learning Agenda Project Tanzania (Mar 2015-Sep 2016)
- Developed study protocol, coordinated IRB, managed qualitative and quantitative data collection in Iringa, Tanzania, and conducted mixed methods analyses for case study of an integrated HIV-MNCH community health worker (CHW) model

Graduate Research Assistant, Systems Thinking (Apr 2015-Sep 2015)
- Coordinated preparation for a workshop on systems thinking concepts and application of systems thinking to implementation challenges**;** Developed "How To" workshop handouts for common systems thinking tools and supported facilitation of active learning exercises

Graduate Research Assistant, CHW Program Case Studies (Nov 2013-Jan 2015)
- Authored three case studies of community health worker programs (Zambia, Zimbabwe, and Indonesia) which were included in MCHIP's recently published CHW Reference Guide
- Supported literature review, data gathering, and strategy framing for Dr. Henry Perry's CHW program consultation to the Integrated Delivery team at Bill and Melinda Gates Foundation

Graduate Research Assistant, Mental Health Monitoring & Evaluation (Jun 2014-Jul 2014)
- Conducted narrative review and logic framework analysis to support development of a M&E framework for mental health and psychosocial support interventions

ICF International, Maternal and Child Survival Program **Washington, DC**

Consultant to Community Health Team (Jul 2015-Jan 2017)

- Conducted literature review on implementation principles of community health
- Summarized existing health systems strengthening frameworks and provided writing and editorial support for community health systems manuscripts
- Conducted literature review, analysis, and co-authored brief "The Cost and Cost-Effectiveness of Community Health Investments in Reproductive, Maternal, Neonatal, and Child Health"

World Health Organization **Baltimore, MD**

Consultant to WHO's Global Observatory for eHealth (Nov 2015-Jan 2016)

- Performed quantitative analyses and data interpretation for WHO's 3rd Global Survey on eHealth: "Global diffusion of eHealth: Making universal health coverage achievable"

Jhpiego Maternal and Child Survival Program **Washington, DC**

Community Health Internship, ICF International (Apr 2015-Jun 2015)

- Supported development of a framework for inclusion of community health into global health systems strengthening strategies; Conducted literature review of relationship between community health components and WHO health systems building blocks

Bill and Melinda Gates Foundation **Seattle, WA**

Summer Internship Program, Integrated Development (Jun 2014-Aug 2014)

- Worked with HIV diagnostics team to explore the viability of extending point of care CD4 testing to the community-level. Traveled to Kenya and Zambia to interview key stakeholders
- Developed target product profile of CD4 device for community-level use case

Clinton Health Access Initiative **Boston, MA & Lusaka, Zambia**

Consultant, CHAI Zambia Human Resources for Health Team (Jan 2015-Oct 2015)

- Drafted manuscript for the Community Health Assistant (CHA) process evaluation in Zambia

Senior Research Associate, Applied Analytics Team (Aug 2012-Jul 2013)

- Led qualitative process evaluation of the roll out of the CHA cadre in Zambia, including data collection and analysis of interviews with over 75 key informants
- Developed model guidance for operational cost considerations WHO 2010 PMTCT guidelines
- Supported design, analytics, and M&E for UNICEF/DFID HIV Point-of-Care diagnostics grant

Research Associate, Applied Analytics Team (Oct 2010-Jul 2012)

- Provided technical assistance on M&E plans for Prevention of Mother-to-Child Transmission (PMTCT) of HIV programs in 8 high burden countries
- Analyzed cross-sectional and longitudinal cohort data of key PMTCT cascade indicators, and assisted with writing quarterly donor reports; Supported proposal design and grant writing

The Elizabeth Glaser Pediatric AIDS Foundation **Washington, DC**

Senior Research Associate, GWU-EGPAF Partnership (Jul 2008-Oct 2010)

- Supported WHO/Gates Foundation-funded operations research to pilot rapid syphilis testing (RST) within PMTCT programs in Uganda and Zambia, including IRB coordination, protocol revisions, work planning, budgeting, M&E design, data collection/analysis plans, and reporting
- Designed qualitative survey to assess provider perspectives on ease-of-use of new RST kit
- Collected costs and time-motion data for cost-effectiveness analysis of RST in ANC

George Washington University School of Public Health **Washington, DC**

Senior Research Associate and Data Manager (Jul 2008-Oct 2010)

- Prepared site activation of two NIH-funded HIV Prevention Trials Network (HPTN 061, 064)
- Trained and managed staff on data processes, confidentiality, and quality assurance checks

Research Assistant and Field Interviewer (May 2006-Jul 2008)

- Supported implementation of two cycles of CDC-funded National HIV Behavioral Surveillance Study; Administered 200+ HIV tests and structured interviews

DATA ANALYSIS SKILLS

Quantitative Programs:	Stata, ArcGIS, Microsoft Excel, UCINET, Vensim, LiST model
Qualitative Programs:	MaxQDA, Dedoose, Atlas.ti

PUBLICATIONS

1. Sacks E, Swanson RC, Schensul JJ, Gleave A, **Shelley KD**, Were MK, Chowdhury AM, LeBan K, Perry HB. Community involvement in health systems strengthening to improve global health outcomes: a review of guidelines and approaches. International Quarterly of Community Health Education. Revise and resubmit.
2. **Shelley KD**, Belete Y, Phiri S, Mutinta M, Chibawe C, Musonda M, et al. Implementation of the Community Health Assistant cadre in Zambia: A process evaluation to guide future scale-up decisions. J Community Health. 2015;1–11.
3. **Shelley KD**, Ansbro ÉM, Ncube AT, Sweeney S, Fleischer C, Tembo-Mumba G, et al. Scaling down to scale up: A health economic analysis of integrating point-of-care syphilis testing into antenatal care in Zambia during pilot and national rollout implementation. PLoS One. 2015;10(5):1–19.
4. Ansbro ÉM , Gill M, Reynolds J, **Shelley KD**, Strasser S, Sripipatana T, et al. Introduction of syphilis point-of-care tests, from pilot study to national programme implementation in Zambia: a qualitative study of impact of healthcare workers' perspectives on testing experience, training and quality assurance. PLoS One. 2015;10(6):1–18.
5. Terris-prestholt F, Vickerman P, Torres-Rueda S, Santesso N, Sweeney S, Mallma P, et al. The cost-effectiveness of 10 antenatal syphilis screening and treatment approaches in Peru, Tanzania, and Zambia. Int J Gynecol Obstet. International Federation of Gynecology and Obstetrics; 2015;16–20.
6. Perry HB, Zulliger R, Scott K, Javadi D, Gergen J, **Shelley KD**, et al. Case studies of large-scale community health worker programs: Examples from Afghanistan, Bangladesh, Brazil, Ethiopia, India, Indonesia, Iran, Nepal, Pakistan, Rwanda, Zambia, and Zimbabwe. In: Perry HB, Crigler L, editors. Developing and Strengthening Community Health Worker Programs at Scale: A Reference Guide and Case Studies for Program Managers and Policymakers. Washington, DC: USAID, MCHIP; 2014. Appendix A, p. 1–100.
7. Phillips G, Magnus M, Kuo I, **Shelley KD**, Rawls A, West-Ojo T, et al. Correlates of frequency of HIV testing among men who have sex with men in Washington, DC. AIDS Care. 2013;25(12):1481–4.
8. Strasser S, Bitarakwate E, Gill M, Hoffman HJ, Musana O, Phiri A, et al. Introduction of rapid syphilis testing within prevention of mother-to-child transmission of HIV programs in Uganda and Zambia: a field acceptability and feasibility study. J Acquir Immune Defic Syndr. 2012 Nov 1;61(3):e40–6.
9. Phillips G, Magnus M, Kuo I, **Shelley KD**, Rawls A, West-Ojo T, et al. Oral versus anal sex at last encounter–behavioral differences among men who have sex with men in the District of Columbia. AIDS Care. 2012;24(6):793–8.
10. Magnus M, Kuo I, Phillips G, **Shelley KD**, Rawls A, Montanez L, et al. Elevated HIV prevalence despite lower rates of sexual risk behaviors among black men in DC who have sex with men. AIDS Patient Care STDS. 2010;24(10):615–22.
11. Magnus M, Kuo I, **Shelley KD**, Rawls A, Peterson J, Montanez L, et al. Risk factors driving the emergence of a generalized heterosexual HIV epidemic in Washington, DC networks at risk. Aids. 2009;23(10): 1277–84.

PRESENTATIONS

1. **Shelley KD**. Application of a systems thinking lens to the design of effective and sustainable scale-up of national community health programs. Poster session presented at: 6th Annual Conference of Global Health of the Consortium of Universities for Global Health; 2015 Mar 26-28; Boston, MA.
2. Belete YW, **Shelley KD**, et al. Lessons learned from the pilot class of Community Health Assistants (CHA) in Zambia: A process evaluation to inform national scale up of the CHA program. Poster session presented at: 3rd Global Symposium on Health Systems Research; 2014 Sep 30-Oct 3; Cape Town, South Africa.
3. Brouliette A, Yavuz E, **Shelley KD**, Tenywa T, Nyegenye W, Grosz J. Improved access to CD4 testing following introduction of Point-of-Care technology in Uganda. Poster session presented at: 7th International AIDS Society Conference on HIV Pathogenesis, Treatment, and Prevention; 2013 Jun 30-Jul 3; Kuala Lumpur, Malaysia.
4. Chemey E, Kandodo J, Reiner C, **Shelley KD**, et al. Expert client initiative improves PMTCT services in Machinga, Malawi. Poster session presented at: 19th International AIDS Conference; 2012 Jul 22-28; Washington, DC, USA.
5. Molisho M, Michaelis A, **Shelley KD**, et al. Increasing retention in care for prevention of MTCT in Machinga District, Malawi through an integrated service delivery model: the Mother-Infant Pair (MIP) clinic. Poster session presented at: 19th International AIDS Conference; 2012 Jul 22-28; Washington, DC, USA.
6. McCarthy E, **Shelley KD**, Romano S. Achieving elimination of new HIV infections among children by 2015 and keeping their mothers alive in Zambia and globally requires dramatically improving receipt of all critical services for pregnant women and their infants from the beginning of pregnancy through the end of breastfeeding. Poster session presented at: 19th International AIDS Conference; 2012 Jul 22-28; Washington, DC, USA.
7. Strasser S, Bitarakwate E, Chintu N, Sripipatana T, **Shelley KD** et al. Introduction of rapid syphilis testing strengthens health systems and health worker capacity to provide integrated PMTCT services. Oral session presented at: WHO symposium on Speeding up elimination of congenital syphilis with rapid syphilis testing: progress and challenges. 19th Meeting of the International Society for Sexually Transmitted Diseases Research Conference; 2011 Jul 10-13; Quebec City, Canada.
8. Bitarakwate E, Strasser S, Sripipatana T, Chintu N, **Shelley KD**, et al. Introduction of rapid syphilis testing within prevention of mother-to-child transmission of HIV programs in Uganda and Zambia: A field acceptability and feasibility study. Poster session presented at: 6th International AIDS Society Conference on HIV Pathogenesis, Treatment, and Prevention; 2011 Jul 17-20; Rome, Italy.
9. **Shelley KD**, Watson CW, et al. Venue based recruitment among heterosexual women at high risk for HIV in Washington, DC: Data from HPTN 064. Poster session presented at: HIV Prevention Trials Network Annual Meeting; 2010 Jun 6-10; Washington, DC, USA.
10. Watson CW, **Shelley KD**, et al. Developing effective recruitment strategies targeting black men who have sex with men in Washington, DC: Data from HPTN 061. Poster session presented at: HIV Prevention Trials Network Annual Meeting; 2010 Jun 6-10; Washington, DC, USA.
11. Magnus M, Kuo I, Phillips G II, **Shelley KD** et al. High HIV prevalence despite lower rates of sexual risk behaviors among MSM of color in Washington, DC. Poster session presented at: 17th Conference on Retroviruses and Opportunistic Infections; 2010 Feb 16-19; San Francisco, CA, USA.

12. Strasser S, Chintu N, Sripipitana T, **Shelley KD**, Guay L, Wilfert C. Introduction of rapid syphilis testing within an integrated prevention of mother to child transmission (PMTCT) of HIV program: A field acceptability, feasibility, and cost effectiveness pilot in Zambia. Poster session presented at: 11th World Congress of the International Union Against Sexually Transmitted Infection; 2009 Nov 9-12; Cape Town, South Africa.
13. Bitarakwate E, Sripipitana T, **Shelley KD**, Guay L, Wilfert C. The uptake and cost-effectiveness of introduction of rapid syphilis testing in antenatal care and its feasibility of integrating into Prevention of Mother to Child Transmission (PMTCT) Programs in Uganda. Poster session presented at: 11th World Congress of the International Union Against Sexually Transmitted Infections; 2009 Nov 9-12; Cape Town, South Africa.
14. Kuo I, Magnus M, **Shelley KD** et al. Substance use and unprotected anal intercourse among MSM in Washington, DC. Poster session presented at: National HIV Prevention Conference; 2009 Aug 26-29; Atlanta, GA, USA.
15. Magnus M, Kuo I, **Shelley KD** et al. Characteristics associated with missed opportunities for HIV testing: Washington DC. Poster session presented at: 16th Conference on Retroviruses and Opportunistic Infections; 2009 Feb 8-11; Montreal, Canada.
16. **Shelley KD**, Sharp J, Tenner A, Ogusky J, McGregor A, Kuo I. Education in the District of Columbia: An evaluation of the Making Proud Choices! Program. Plenary oral session presented at: Annual Reproductive Health Conference of the Association of Reproductive Health Professionals; 2008 Sep 17-20; Washington, DC, USA.
17. Magnus M, Kuo I, Rawls AL, **Shelley KD** et al. Gender differences in sexual and HIV testing behaviors among heterosexuals at high risk for HIV in Washington, DC. Poster session presented at: 15th Conference on Retroviruses and Opportunistic Infections; 2008 Feb 3-6; Boston, MA, USA.
18. Kuo I, Magnus M, **Shelley KD** et al. Knowledge and perceptions of routine HIV screening in medical settings within an urban, community based population in DC. Poster session presented at: National HIV Prevention Conference; 2007 Dec 2-5; Atlanta, GA, USA.
19. Magnus M, Kuo I, **Shelley KD** et al. Associations between routine HIV screening and unprotected sex: HIV-negative results not associated with increase in risk taking. Poster session presented at: National HIV Prevention Conference; 2007 Dec 2-5; Atlanta, GA, USA.
20. **Shelley KD**, Kuo I, Magnus M et al. Perceived knowledge of partner's serostatus and multiple sex partners: preliminary analysis of heterosexuals at high risk for HIV in DC. Poster session presented at: 6th Annual International Conference on Urban Health; 2007 Oct 31-Nov2; Baltimore, MD, USA.
21. Kuo I, Magnus M, **Shelley KD** et al. Homelessness and HIV risk behaviors in urban sample of heterosexuals at high risk for HIV. Poster session presented at: 6th Annual International Conference on Urban Health; 2007 Oct 31-Nov2; Baltimore, MD, USA.
22. Magnus M, Kuo I, **Shelley KD** et al. Heterosexuals at high risk of HIV acquisition in Washington, DC: Sexual behavioral differences between urban neighborhoods. Oral session presented at: 6th Annual International Conference on Urban Health; 2007 Oct 31-Nov2; Baltimore, MD, USA.
23. Peterson JA, Kuo I, Magnus M, **Shelley KD** et al. Ethnographically informed formative assessment: Understanding HIV risk populations in an urban city – The DC example. Poster session presented at: 6th Annual International Conference on Urban Health; 2007 Oct 31-Nov2; Baltimore, MD, USA.

TEACHING EXPERIENCE

Johns Hopkins School of Arts and Sciences, Instructor	**Baltimore, MD**
Medical Geography	Intersession 2016
Johns Hopkins School of Public Health, Teaching Assistant	**Baltimore, MD**
Applications in Managing Health Organizations in LMICs	Term 1, 2016-17
Social and Behavioral Foundations of Primary Health Care	Term 3, 2015-16
Health Behavior Change at Individual, Household, Community Levels	Term 2, 2015-16
Health Information Systems	Term 2, 2015-16
Introduction to International Health	Term 1, 2014-15
Economic Evaluation I	Term 2, 2014-15
Health Systems Research and Evaluation in Developing Countries	Term 3, 2014-15
Health Systems Program Seminar	Term 2-3, 2014-15
George Washington School of Public Health, Teaching Assistant	**Washington, DC**
Geographic Information Systems	2006-10
Advanced Epidemiology Methods	Spring 2010

PROFESSIONAL MEMBERSHIPS

Health Systems Global	2016–2017
Consortium of Universities for Global Health	2015–2016
International AIDS Society	2012–2013
International Union Against Sexually Transmitted Infections	2009–2010
Association of Reproductive Health Professionals	2008–2009
International Society of Urban Health	2007–2008

HONORS & ACTIVITIES

Richard Morrow Award in Health Systems 2016
Johns Hopkins School of Public Health, International Health

Alison Snow Jones Memorial Prize 2016
Johns Hopkins School of Public Health, Health Policy & Management

Preparing Future Faculty Teaching Academy Fellowship 2015–2016
Johns Hopkins University

Conference Scholarship, 6th Consortium of Universities for Global Health 2015
Johns Hopkins University Center for Global Health

Delta Omega National Honorary Society in Public Health Inducted 2008
George Washington University, School of Public Health Chapter

Excellence in Culminating Experience Award – Epidemiology & Biostatistics 2008
George Washington University, School of Public Health & Health Services

Chair's Award for Excellence in Research – Epidemiology & Biostatistics 2008
George Washington University, School of Public Health & Health Services

Tauber Scholarship 2006
George Washington University, School of Public Health & Health Services

Gamma Theta Upsilon Inducted 2003
International Geography Honors Society

Dean's Award for Academic Excellence Fall 2001,2002;
Colgate University Spring 2002, 2003, 2004, 2005